# User's Manual

EXA

## Model SC202G [Style: S3], SC202S [Style: S3]

# 2-wire Conductivity or Resistivity Transmitter

IM 12D08B02-01E

vigilantplant®

YOKOGAWA
Yokogawa Electric Corporation

IM 12D08B02-01E
8th Edition

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**Revision Record .....i**

In this manual a **mA** ign appears if it concerns the SC202G -A and SC202S-A, -N, -K.

## DANGER

**Electric discharge**

The EXA analyzer contains devices that can be damaged by electrostatic discharge. When servicing this equipment, please observe proper procedures to prevent such damage. Replacement components should be shipped in conductive packaging. Repair work should be done at grounded workstations using grounded soldering irons and wrist straps to avoid electrostatic discharge.

**Installation and wiring**

The EXA analyzer should only be used with equipment that meets the relevant international and regional standards. Yokogawa accepts no responsibility for the misuse of this unit.

## CAUTION

The instrument is packed carefully with shock absorbing materials, nevertheless, the instrument may be damaged or broken if subjected to strong shock, such as if the instrument is dropped. Handle with care.

Although the instrument has a weatherproof construction, the transmitter can be harmed if it becomes submerged in water or becomes excessively wet.

Do not use an abrasive material or solvent when cleaning the instrument.

Do not modify the SC202 transmitter.

## WARNING

Electrostatic charge may cause an explosion hazard. Avoid any actions that cause the generation of electrostatic charge, e.g., rubbing with a dry cloth.

**Warning label**

Because the enclosure of the Dissolved Oxygen transmitter Type SC202S-A, -P, -F are made of aluminium, if it is mounted in an area where the use of category 1 G Zone 0 apparatus is required, it must be installed such, that, even in the event of rare incidents, ignition sources due to impact and friction sparks are excluded.

**Notice**

- This manual should be passed on to the end user.
- The contents of this manual are subject to change without prior notice.
- The contents of this manual shall not be reproduced or copied, in part or in whole, without permission.
- This manual explains the functions contained in this product, but does not warrant that they are suitable the particular purpose of the user.
- Every effort has been made to ensure accuracy in the preparation of this manual. However, when you realize mistaken expressions or omissions, please contact the nearest Yokogawa Electric representative or sales office.
- This manual does not cover the special specifications. This manual may be left unchanged on any change of specification, construction

  or parts when the change does not affect the functions or performance of the product.

- If the product is not used in a manner specified in this manual, the safety of this product may be impaired.

Yokogawa is not responsible for damage to the instrument, poor performance of the instrument or losses resulting from such, if the problems are caused by:

- Improper operation by the user.
- Use of the instrument in improper applications
- Use of the instrument in an improper environment or improper utility program
- Repair or modification of the related instrument by an engineer not authorized by Yokogawa.

**Safety and Modification Precautions**

- Follow the safety precautions in this manual when using the product to ensure protection and safety of the human body, the product and the system containing the product.

**The following safety symbols are used on the product as well as in this manual.**

DANGER

This symbol indicates that an operator must follow the instructions laid out in this manual in order to avoid the risks, for the human body, of injury, electric shock, or fatalities. The manual describes what special care the operator must take to avoid such risks.

WARNING

This symbol indicates that the operator must refer to the instructions in this manual in order to prevent the instrument (hardware) or software from being damaged, or a system failure from occurring.

CAUTION

This symbol gives information essential for understanding the operations and functions.

This symbol indicates Protective Ground Terminal

This symbol indicates Function Ground Terminal (Do not use this terminal as the protective ground terminal.)

This symbol indicates Alternating current.

This symbol indicates Direct current.

**Warranty and service**

Yokogawa products and parts are guaranteed free from defects in workmanship and material under normal use and service for a period of (typically) 12 months from the date of shipment from the manufacturer. Individual sales organizations can deviate from the typical warranty period, and the conditions of sale
relating to the original purchase order should be consulted. Damage caused by wear and tear, inadequate maintenance, corrosion, or by the effects of chemical processes are excluded from this warranty coverage.

In the event of warranty claim, the defective goods should be sent (freight paid) to the service department of the relevant sales organization for repair or replacement (at Yokogawa discretion). The following information must be included in the letter accompanying the returned goods:

- Part number, model code and serial number
- Original purchase order and date
- Length of time in service and a description of the process
- Description of the fault, and the circumstances of failure
- Process/environmental conditions that may be related to the installation failure of the device
- A statement whether warranty or non-warranty service is requested
- Complete shipping and billing instructions for return of material, plus the name and phone number of a contact person who can be reached for further information.

Returned goods that have been in contact with process fluids must be decontaminated/disinfected before shipment. Goods should carry a certificate to this effect, for the health and safety of our employees. Material safety data sheets should also be included for all components of the processes to which the equipment has been exposed.

**ATEX Documentation**

This procedure is only applicable to the countries in European Union.

GB

All instruction manuals for ATEX Ex related products are available in English, German and French. Should you require Ex related instructions in your local language, you are to contact your nearest Yokogawa office or representative.

DK

Alle brugervejledninger for produkter relateret til ATEX Ex er tilgængelige på engelsk, tysk og fransk. Skulle De ønske yderligere oplysninger om håndtering af Ex produkter på eget sprog, kan De rette henvendelse herom til den nærmeste Yokogawa afdeling eller forhandler.

I

Tutti i manuali operativi di prodotti ATEX contrassegnati con Ex sono disponibili in inglese, tedesco e francese. Se si desidera ricevere i manuali operativi di prodotti Ex in lingua locale, mettersi in contatto con l'ufficio Yokogawa più vicino o con un rappresentante.

E

Todos los manuales de instrucciones para los productos antiexplosivos de ATEX están disponibles en inglés, alemán y francés. Si desea solicitar las instrucciones de estos artículos antiexplosivos en su idioma local, deberá ponerse en contacto con la oficina o el representante de Yokogawa más cercano.

NL

Alle handleidingen voor producten die te maken hebben met ATEX explosiebeveiliging (Ex) zijn verkrijgbaar in het Engels, Duits en Frans. Neem, indien u aanwijzingen op het gebied van explosiebeveiliging nodig hebt in uw eigen taal, contact op met de dichtstbijzijnde vestiging van Yokogawa of met een vertegenwoordiger.

SF

Kaikkien ATEX Ex -tyyppisten tuotteiden käyttöhjeet ovat saatavilla englannin-, saksan- ja ranskankielisinä. Mikäli tarvitsette Ex -tyyppisten tuotteiden ohjeita omalla paikallisella kielellännne, ottakaa yhteyttä lähimpään Yokogawa-toimistoon tai -edustajaan.

P

Todos os manuais de instruções referentes aos produtos Ex da ATEX estão disponíveis em Inglês, Alemão e Francês. Se necessitar de instruções na sua língua relacionadas com produtos Ex, deverá entrar em contacto com a delegação mais próxima ou com um representante da Yokogawa.

F

Tous les manuels d'instruction des produits ATEX Ex sont disponibles en langue anglaise, allemande et française. Si vous nécessitez des instructions relatives aux produits Ex dans votre langue, veuillez bien contacter votre représentant Yokogawa le plus proche.

D

Alle Betriebsanleitungen für ATEX Ex bezogene Produkte stehen in den Sprachen Englisch, Deutsch und Französisch zur Verfügung. Sollten Sie die Betriebsanleitungen für Ex-Produkte in Ihrer Landessprache benötigen, setzen Sie sich bitte mit Ihrem örtlichen Yokogawa-Vertreter in Verbindung.

S

Alla instruktionsböcker för ATEX Ex (explosionssäkra) produkter är tillgängliga på engelska, tyska och franska. Om Ni behöver instruktioner för dessa explosionssäkra produkter på annat språk, skall Ni kontakta närmaste Yokogawakontor eller representant.

GR

Όλα τα εγχειρίδια λειτουργίας των προϊόντων με ATEX Ex διατίθενται στα Αγγλικά, Γερμανικά και Γαλλικά. Σε περίπτωση που χρειάζεστε οδηγίες σχετικά με Ex στην τοπική γλώσσα παρακαλούμε επικοινωνήστε με το πλησιέστερο γραφείο της Yokogawa ή αντιπρόσωπο της.

SK

Všetky návody na obsluhu pre prístroje s ATEX Ex sú k dispozícii v jazyku anglickom, nemeckom a francúzskom. V prípade potreby návodu pre Ex-prístroje vo Vašom národnom jazyku, skontaktujte prosím miestnu kanceláriu firmy Yokogawa.

CZ

Všechny uživatelské příručky pro výrobky, na něž se vztahuje nevýbušné schválení ATEX Ex, jsou dostupné v angličtině, němčině a francouzštině. Požadujete-li pokyny týkající se výrobků s nevýbušným schválením ve vašem lokálním jazyku, kontaktujte prosím vaši nejbližší reprezentační kancelář Yokogawa.

LT

Visos gaminiø ATEX Ex kategorijos Eksploatavimo instrukcijos teikiami anglø, vokieèiø ir prancûzø kalbomis. Norëdami gauti prietaisø Ex dokumentacijà kitomis kalbomis susisiekite su artimiausiu bendrovës “Yokogawa” biuru arba atstovu.

LV

Visas ATEX Ex kategorijas izstrâdâjumu Lietoðanas instrukcijas tiek piegâdâtas angïu, vâcu un franèu valodâs. Ja vçlaties saòemt Ex ierîèu dokumentâciju citâ valodâ, Jums ir jâsazinâs ar firmas Jokogava (Yokogawa) tuvâko ofisu vai pârstâvi.

EST

Kõik ATEX Ex toodete kasutamisjuhendid on esitatud inglise, saksa ja prantsuse keeles. Ex seadmete muukeelse dokumentatsiooni saamiseks pöörduge lähima Iokagava (Yokogawa) kontori või esindaja poole.

PL

Wszystkie instrukcje obsługi dla urządzeń w wykonaniu przeciwwybuchowym Ex, zgodnych z wymaganiami ATEX, dostępne są w języku angielskim, niemieckim i francuskim. Jeżeli wymagana jest instrukcja obsługi w Państwa lokalnym języku, prosimy o kontakt z najbliższym biurem Yokogawy.

SLO

Vsi predpisi in navodila za ATEX Ex sorodni pridelki so pri roki v angliščini, nemščini ter francoščini. Èe so Ex sorodna navodila potrebna v vašem tukejnjem jeziku, kontaktirajte vaš najbliši Yokogawa office ili predstaunika.

H

Az ATEX Ex mûszerek gépkönyveit angol, német és francia nyelven adjuk ki. Amennyiben helyi nyelven kérik az Ex eszközök leírásait, kérjük keressék fel a legközelebbi Yokogawa irodát, vagy képviseletet.

BG

Всички упътвания за продукти от серията ATEX Ex се предлагат на английски, немски и френски език. Ако се нуждаете от упътвания за продукти от серията Ex на родния ви език, се свържете с най-близкия офис или представителство на фирма Yokogawa.

RO

Toate manualele de instructiuni pentru produsele ATEX Ex sunt in limba engleza, germana si franceza. In cazul in care doriti instructiunile in limba locala, trebuie sa contactati cel mai apropiat birou sau reprezentant Yokogawa.

M

Il manwali kollha ta 1 istruzzjonijiet għal prodotti mmarbuta ma’ ATEX Ex huma disponibbli bl-Ingliż, bil-Ġermaniż u bil-Franċiż. Jekk tkun teħtieġ struzzjonijiet marbuta ma’ Ex fil-lingwa lokali tiegħek, għandek tikkuntattja lill-eqreb rappreżentan jew uffiċċju ta’ Yokogawa

## CONFIGURATION CHECKLIST FOR SC202

| Primary choices | default | alternatives | reference on page | menu |
|---|---|---|---|---|
| **Measurement** | **Conductivity** | Resistivity | 5.8- 5.9 | SC 01 |
| **Range** | **0-1000 µS/cm** | max. 1999 mS/cm | 5.3 | “range” |
| **Temperature unit** | **Celsius** | Fahrenheit | 5.10- 5.11 | SC 11 |
| **Sensor** | | | | |
| **Cell constant** | **0.1 /cm** | any value between 0.08 and 50 | 5.8-5.9, 6.1- 6.3 | SC 03 |
| **Sensor type** | **2-electrode** | 4- electrode | 5.8- 5.9 | SC 02 |
| **Temperature compensator** | **Pt1000** | Ni100, Pt100, 8k55, Pb36 | 5.10-5.11 | SC 10 |
| **Choices** | | | | |
| Communication | enabled | disable HART(R), PH201*B | 5.19 | SC 60- 62 |
| Burn out | inactive | HI or LO output on fail | 5.14- 5.15 | SC 32 |
| Temperature compensation | NaCl in water | fixed T.C., matrix | 5.12, 5.13, 5.5 | SC 20- 28; “temp” |
| USP functionality | inactive | Fail if USP limits are exceeded | 9.1, 9.2, 5.17 | SC 57 |
| HOLD during maintenance | inactive | HOLD last value or fixed value | 5.17, 5.3- 5.4 | “hold”, SC 50 |
| Calibration temperature | inactive | adjustment +/- 15 °C | 5.11 | SC 12 |
| ZERO calibration | inactive | adjustment +/-1 µS/cm | 5.9 | SC 04 |
| Diagnostics | hard alarm on all errors | hard or soft choices | 5.17 | SC 53 |
| Cell fouling alarm | active | except E13 inactive | 5.9 | SC 05 |
| Password protection | inactive | password for different levels | 5.17 | SC 52 |
| Output in Concentration units | inactive | linearization of output, w% on LCD | 5.14 - 5.17 | SC 31/35/55 |

## 1. INTRODUCTION AND GENERAL DESCRIPTION

The Yokogawa EXA 202 is a 2-wire transmitter designed for industrial process monitoring, measurement and control applications. This user's manual contains the information needed to install, set up, operate and maintain the unit correctly. This manual also includes a basic troubleshooting guide to answer typical user questions.

Yokogawa can not be responsible for the performance of the EXA analyzer if these instructions are not followed.

### 1-1. Instrument check

Upon delivery, unpack the instrument carefully and inspect it to ensure that it was not damaged during shipment. If damage is found, retain the original packing materials (including the outer box) and then immediately notify the carrier and the relevant Yokogawa sales office.

Make sure the model number on the textplate affixed to the side of the instrument agrees with your order. Examples of nameplates are shown below.

mA

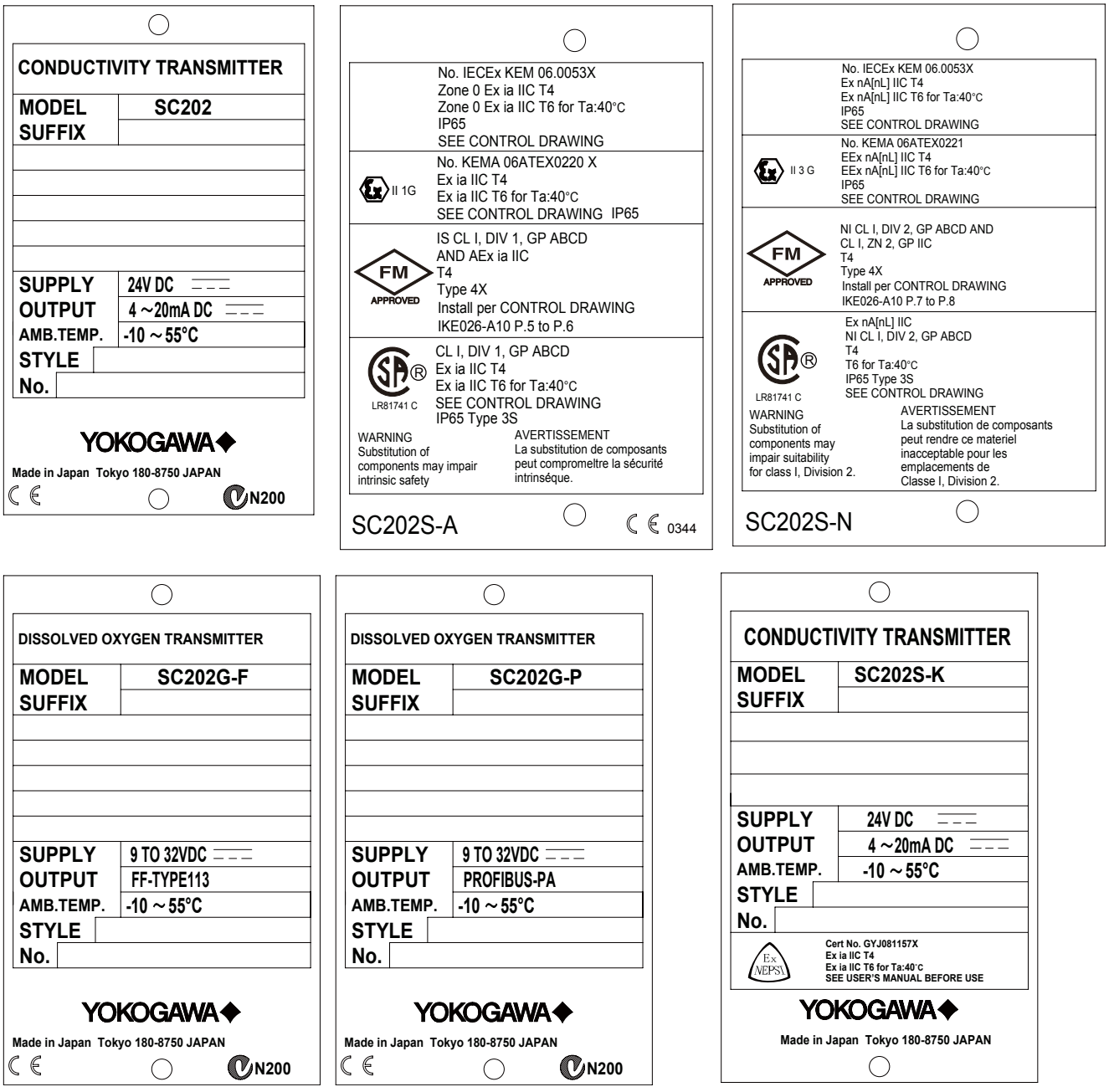



**Figure 1-1. Nameplate**

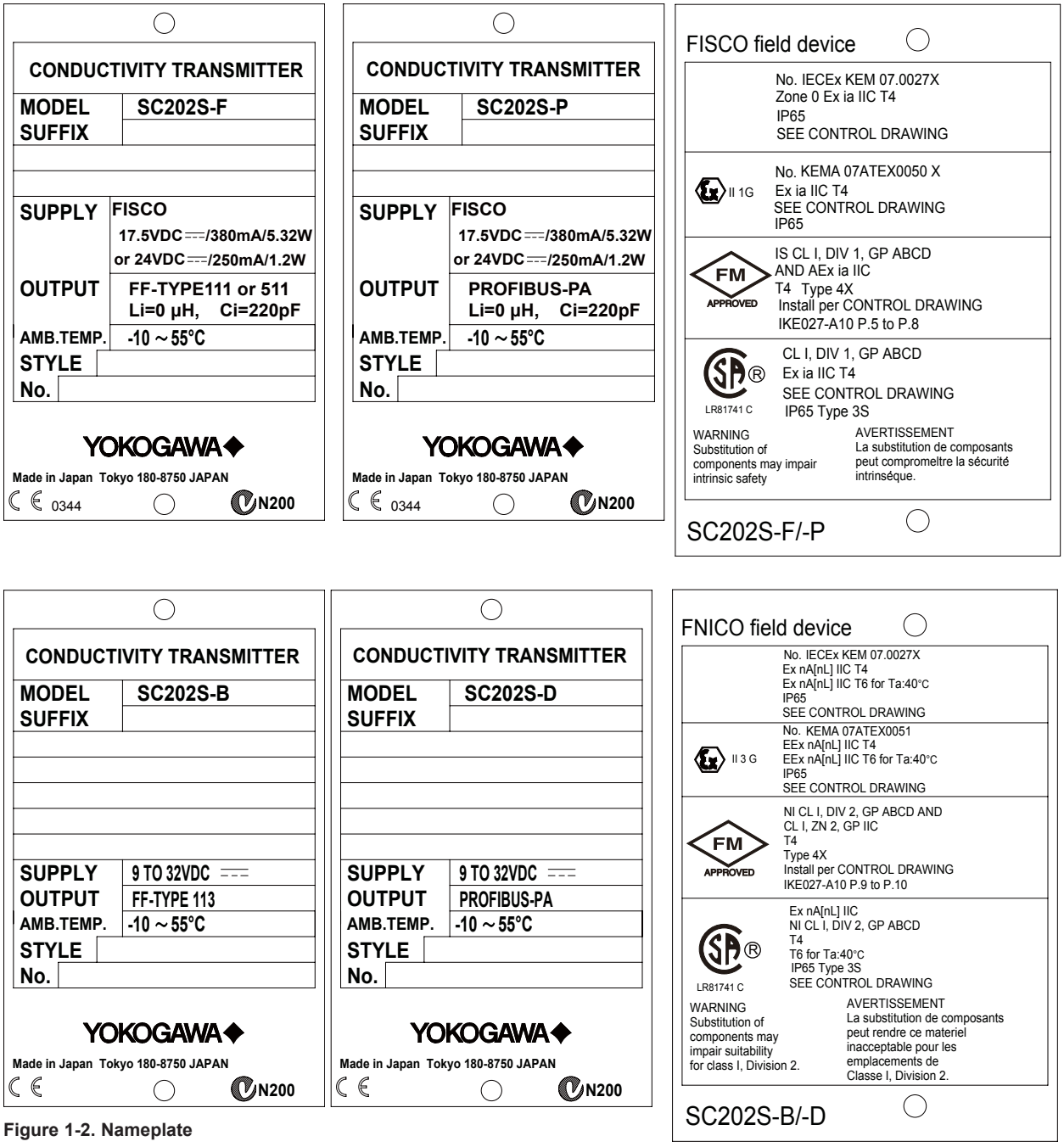



**Figure 1-2. Nameplate**

**NOTE**: Check that all the parts are present, including mounting hardware, as specified in the option codes at the end of the model number.
For a description of the model codes, refer to Chapter 2 of this manual under General Specifications.

Basic Parts List:Transmitter SC202
User's Manual English
Optional mounting hardware when specified (See model code)

**1-2. Application**

The EXA transmitter is intended to be used for continuous on-line measurement in industrial installations. The unit combines simple operation and microprocessor-based performance with advanced self-diagnostics and enhanced communications capability to meet the most advanced requirements. The measurement can be used as part of an automated process control system. It can also be used to indicate dangerous limits of a process, to monitor product quality, or to function as a simple controller for a dosing/neutralisation system.

Yokogawa designed the EXA analyzer to withstand harsh environments. The transmitter may be installed either indoors or outside because the IP65 (NEMA 4X) housing and cabling glands ensure the unit is adequately protected. The flexible polycarbonate window on the front door of the EXA allows pushbutton access to the keypad, thus preserving the water and dust protection of the unit even during routine maintenance operations.

A variety of EXA hardware is optionally available to allow wall, pipe, or panel mounting. Selecting a proper installation site will permit ease of operation. Sensors should normally be mounted close to the transmitter in order to ensure easy calibration and peak performance.

The EXA is delivered with a general purpose default setting for programmable items. (Default settings are listed in Chapter 5 and again in Chapter 11). While this initial configuration allows easy start-up, the configuration should be adjusted to suit each particular application. An example of an adjustable item is the type of temperature sensor used. The EXA can be adjusted for any one of five different types of temperature sensors.

To record such configuration adjustments, write changes in the space provided in Chapter 11 of this manual. Because the EXA is suitable for use as a monitor, a controller or an alarm instrument, program configuration possibilities are numerous.

Details provided in this user's manual are sufficient to operate the EXA with all Yokogawa sensor systems and a wide range of third-party commercially available probes. For best results, read this manual in conjunction with the corresponding sensor user's manual.

Yokogawa designed and built the EXA to meet the CE regulatory standards. The unit meets or exceeds stringent requirements of EN61326 Class A without compromise, to assure the user of continued accurate performance in even the most demanding industrial installations.

## 2. GENERAL SPECIFICATIONS

### 2-1. Specifications

**A. Input specifications**

: Two or four electrodes measurement with square wave excitation. Cell constants from 0.008 to 50 $cm^{-1}$.

**B. Detection method**

: Frequency, read-pulse position and reference voltage are dynamically optimized.

**C. Input ranges**

- Conductivity :
  Minimum : 0 µS/cm
  Maximum : 200 mS x (Cell constant) (overrange 1999 mS / cm).
- Resistivity :
  Minimum : 0.005 kΩ/ (Cell constant)
  Maximum : 999 MΩ x cm
- Temperature
  Pt1000 : -20 to +250 °C (0 to 500 °F)
  Pt100 and Ni100 : -20 to +200 °C (0 to 400 °F)
  8K55 NTC : -10 to +120 °C (10 to 250 °F)
  PB36 NTC : -20 to +120 °C (0 to 250 °F)

**mA D. Output Span**

- Conductivity : - min 0.01µS/cm
  : - max. 1999 mS/cm. (max 90% zero suppression)
- Resistivity : - min 0.001kΩxcm
  : - max. 999 MΩ x cm. (max 90% zero suppression)

**mA E. Transmission Signal**

: Isolated output of 4-20 mA DC
Burn up (21 mA) or Burn down
(3.6 mA when HART® or distributor comm. is non-used, 3.9 mA when HART® or distributor comm. is used) or pulse of 21 mA to signal failure.

**F. Temperature compensation**

: Automatic, for temperature ranges mentioned under C (inputs).
- Reference temp.
  : programmable from 0 to 100 °C or 30 to 210 °F (default 25 °C).

**G. Compensation algorithm**

-NaCl : According IEC 60746-3 NaCl tables (default).
-T.C. : Two independent user programmable temperature coefficients, from -0.0% to 3.5% per °C (°F) by adjustment or calibration.
- Matrix : Conductivity function of concentration and temperature. Choice out of 5 preprogrammed matrixes and a 25-point user-programmable matrix.

**H. Logbook**

: Software record of important events and diagnostic data. Available through HART® link, with diagnostic information available in the display.

**I. Display**

: Custom liquid crystal display, with a main display of 31/2 digits 12.5 mm high. Message display of 6 alphanumeric characters, 7 mm high. Warning flags and units (mS/cm, kΩ·cm, µS/cm and MΩ·cm) as appropriate.

**J. Power supply**

: Nominal 24 volt DC loop powered system.
SC202G ; 17 to 40 volts, see Fig.2-1
SC202S : 17 to 31.5 volts, see Fig.2-2
**Maximum load resistance**
For the SC202G, see Fig. 1
200Ω or less with the PH201G
50Ω or less with the SDBT
For the SC202S, see Fig. 2-2

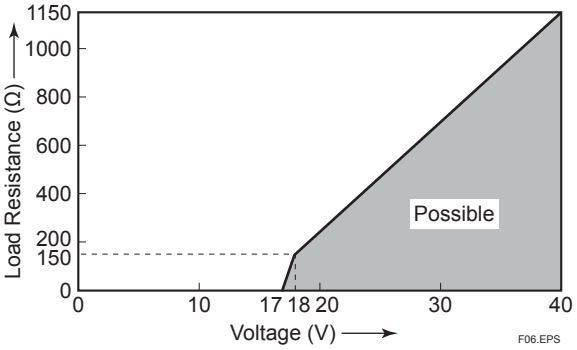



**Fig.2-1 Supply voltage/ load diagram for the SC202G**

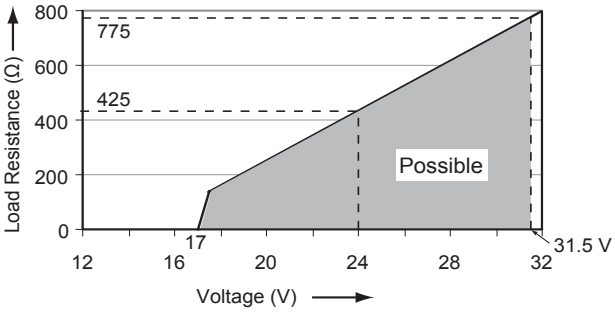



**Fig.2-2 Supply voltage/ load diagram for the SC202S**

**K. Input isolation**

: 1000 VDC

**L. Weight**

| | | |
|---|---|---|
| Body weight | : | approx. 1.6 kg |
| Mounting brackets weight: | | approx. 0.7 kg. |

## 2-2. Operating specifications

**A. Performance** (under reference conditions with sensor simulation)

**Conductivity** (2 µS x K cm$^{-1}$ to 200 mS x K cm$^{-1}$)
- Accuracy : ±0.5% F.S.

**Conductivity** (1 µS x K cm$^{-1}$ to 2 µS x K cm$^{-1}$)
- Accuracy : ±1% F.S.

**Resistivity** (0.005kΩ/ K cm$^{-1}$ to 0.5MΩ/ K cm$^{-1}$)
- Accuracy : ±0.5% F.S.

**Resistivity** (0.5MΩ/ K cm$^{-1}$ to 1MΩ/ K cm$^{-1}$)
- Accuracy : ±1% F.S.

**Temperature** (Pt1000Ω, PB36 NTC, Ni100)
- Accuracy : ±0.3°C

**Temperature** (Pt100Ω, 8.55kΩ NTC) **mA**
- Accuracy : ±0.4°C

**Temperature compensation**
- NaCl table : ±1 %
- Matrix : ±3 %

**Note on performance specifications:**

"F.S." means maximum setting value of transmitter output. "K" means cell constant. YOKOGAWA provides conductivity sensors which cell constant are 0.1 to 10 cm$^{-1}$.
The following tolerance is added to above performance.
mA output tolerance : ± 0.02 mA of "4 - 20 mA"

**Step response:** 90 % (< 2 decades) in 7 seconds

**B. Ambient operating temperature**
: -10 to +55 °C (-10 to 130 ºF)

**C. Storage temperature**
: -30 to +70 °C (-20 to 160 ºF)

**D. Humidity**
: 10 to 90% RH non-condensing

**E. Housing**
: Cast aluminium case with chemically resistant coating, cover with flexible polycarbonate window. Case color is off-white (Equivalent to Munsell 2.5Y8.4/1.2) and cover is Deepsea Moss green (Equivalent to Munsell 0.6GY3.1/2.0). Cable entry is via two PG13.5 nylon glands. Weather resistant to IP65 and NEMA 4X standards. Pipe wall or panel mounting, using optional hardware.

**F. Data protection**
: EEPROM for configuration and logbook

**G. Automatic safeguard**
: Return to measuring mode when no key-stroke is made for 10 min.

**H. Operation protection**
: 3-digit programmable password.

**I. EMC Conformity standards** CE , N200
EN 61326-1 Class A, Table 2
(For use in industrial locations)
EN 61326-2-3
EN 61326-2-5 (pending)

### CAUTION

This instrument is a Class A product, and it is designed for use in the industrial environment. Please use this instrument in the industrial environment only.

**J. Explosionproof type**
Refer to control drawings.

| Item | Description | Code |
|---|---|---|
| Factory Mutual (FM) | **FM Intrinsically safe Approval**<br>Applicable standard: FM3600, FM3610, FM3810<br>Intrinsically Safe for Class I, Division 1, Groups ABCD<br>Class I, Zone 0, AEx ia IIC<br>Temp. Class: T4, Amb. Temp.: -10 to 55°C<br>Intrinsically Safe Apparatus Parameters<br>Vmax=31.5 V, Imax=100 mA,<br>Pmax=1.2 W, Ci=22 nF, Li=35 µH | -A |
| | **FM Non-incendive safe Approval**<br>Applicable standard: FM3600, FM3611, FM3810<br>Non-incendive Safe for Class I, Division 2,<br>Groups ABCD, Zone 2<br>Temp. Class: T4, Amb. Temp.: -10 to 55°C<br>Non-incendive Safe Apparatus Parameters<br>Vmax=31.5 V, Ci=22 nF, Li=35 µH | -N |
| CENELEC ATEX | **CENELEC ATEX (KEMA) Intrinsically safe Approval**<br>Applicable standard: EN60079-0, EN50020<br>EN60079-26<br>Certificate: KEMA 06ATEX0220 X<br>Ex ia IIC, Group: II, Category: 1G<br>Temp. Class: T4, Amb. Temp.: -10 to 55°C<br>T6, Amb. Temp.: -10 to 40°C<br>Ui=31.5 V, Ii=100 mA, Pi=1.2 W, Ci=22 nF, Li=35 µH | -A |
| | **CENELEC ATEX (KEMA) Type of protection "n"**<br>Applicable standard: EN60079-0:2006,<br>EN60079-15:2003<br>Certificate: KEMA 06ATEX0221<br>EEx nA [nL] IIC, Group: II, Category: 3G<br>Temp. Class: T4, Amb. Temp.: -10 to 55°C<br>T6, Amb. Temp.: -10 to 40°C<br>Ui=31.5 V, Ci=22 nF, Li=35 µH | -N |

2.EPS

| Item | Description | Code |
|---|---|---|
| Factory Mutual (FM) | **FM Intrinsically safe Approval**<br>Applicable standard: FM3600, FM3610, FM3810<br>Intrinsically Safe for Class I, Division 1, Groups ABCD<br>Class I, Zone 0, AEx ia IIC<br>Temp. Class: T4, Amb. Temp.: -10 to 55°C<br>Intrinsically Safe Apparatus Parameters<br>Entity { Vmax=24 V, Imax=250 mA, Pmax=1.2 W, Ci=220 pF, Li=0 µH<br>FISCO { Vmax=17.5 V, Imax=380 mA, Pmax=5.32 W, Ci=220pF, Li=0 µH | -P<br>or<br>-F |
| | **FM Non-incendive safe Approval**<br>Applicable standard: FM3600, FM3611, FM3810<br>Non-incendive Safe for Class I, Division 2,<br>Groups ABCD, Zone 2<br>Temp. Class: T4, Amb. Temp.: -10 to 55°C<br>Non-incendive Safe Apparatus Parameters<br>Entity { Vmax=32 V, Pmax=1.2 W, Ci=220 pF, Li=0 µH<br>FNICO { Vmax=32 V, Pmax=5.32 W, Ci=220 pF, Li=0 µH | -B<br>or<br>-D |

FM.EPS

| Item | Description | Code |
|---|---|---|
| CENELEC ATEX Entity | **CENELEC ATEX (KEMA) Intrinsically safe Approval**<br>Applicable standard: EN60079-0, EN50020 EN60079-26<br>Certificate: KEMA 07ATEX0050 X<br>Ex ia IIC, Group: II, Category: 1G<br>Temp. Class: T4, Amb. Temp.: -10 to 55°C<br>Ui=24 V, Ii=250 mA, Pi=1.2 W, Ci=220 pF, Li=0 µH | -P<br>or |
| CENELEC ATEX FISCO | **CENELEC ATEX (KEMA) Intrinsically safe Approval**<br>Applicable standard: EN60079-0, EN50020 EN60079-26, EN60079-27<br>Certificate: KEMA 07ATEX0050 X<br>Ex ia IIC, Group: II, Category: 1G<br>Temp. Class: T4, Amb. Temp.: -10 to 55°C<br>Ui=17.5 V, Ii=380 mA, Pi=5.32 W, Ci=220 pF, Li=0 µH | -F |
| CENELEC ATEX | **CENELEC ATEX (KEMA) Type of protection "n"**<br>Applicable standard: EN60079-0:2006, EN60079-15:2003<br>Certificate: KEMA 07ATEX0051<br>EEx nA [nL] IIC, Group: II, Category: 3G<br>Temp. Class: T4, Amb. Temp.: -10 to 55°C<br>T6, Amb. Temp.: -10 to 40°C<br>Ui=32 V, Ci=220 pF, Li=0 µH | -B<br>or<br>-D |

ATEX.EPS

| Item | Description | Code |
|---|---|---|
| IECEx Scheme Entity | **IECEx Intrinsically safe**<br>Applicable standard: IEC 60079-0, IEC60079-11, IEC60079-26<br>Certificate: IECEx KEM 07.0027X<br>Zone 0 Ex ia IIC<br>Temp. Class: T4, Amb. Temp.: -10 to 55°C<br>Ui=24 V, Ii=250 mA, Pi=1.2 W, Ci=220 pF, Li=0 µH | -P<br>or |
| IECEx Scheme FISCO | **IECEx Intrinsically safe**<br>Applicable standard: IEC 60079-0, IEC60079-11, IEC60079-26, IEC60079-27<br>Certificate: IECEx KEM 07.0027X<br>Zone 0 Ex ia IIC<br>Temp. Class: T4, Amb. Temp.: -10 to 55°C<br>Ui=17.5 V, Ii=380 mA, Pi=5.32 W, Ci=220 pF, Li=0 µH | -F |
| IECEx Scheme | **IECEx Type of protection "n"**<br>Applicable standard: IEC 60079-15:2001, IEC 60079-0:2004<br>Certificate: IECEx KEM 07.0027X<br>Ex nA [nL] IIC<br>Temp. Class: T4, Amb. Temp.: -10 to 55°C<br>T6, Amb. Temp.: -10 to 40°C<br>Ui=32 V, Ci=220 pF, Li=0 µH | -B<br>or<br>-D |

IEC.EPS

mA

| Item | Description | Code |
|---|---|---|
| Canadian Standards Association (CSA) | **CSA Intrinsically safe Approval**<br>Applicable standard: C22.2, No. 0-M1991, C22.2, No. 04-M2004, C22.2, No. 157-M1992, C22.2, No. 61010-1<br>Ex ia Class I, Division 1, Groups ABCD<br>Ex ia IIC<br>Temp. Class: T4, Amb. Temp.: -10 to 55°C<br>T6, Amb. Temp.: -10 to 40°C<br>Ui(Vmax)=31.5 V, Ii(Imax)=100 mA, Pi(Pmax)=1.2 W, Ci=22 nF, Li=35 µH | -A |
| | **CSA Non-incendive safe Approval or type of protection "n"**<br>Applicable standard: C22.2, No.0-M1991, C22.2, No.04-M2004, C22.2, No.157-M1992, C22.2, No.213-M1987, C22.2, No.61010-1<br>Class I, Division 2, Groups ABCD<br>Ex nA [nL] IIC<br>Temp. Class: T4, Amb. Temp.: -10 to 55°C<br>T6, Amb. Temp.: -10 to 40°C<br>Ui(Vmax)=31.5 V, Ci=22 nF, Li=35 µH | -N |
| IECEx Scheme | **IECEx Intrinsically safe**<br>Applicable standard: IEC 60079-0, IEC60079-11, IEC60079-26<br>Certificate: IECEx KEM 06.0053X<br>Zone 0 Ex ia IIC<br>Temp. Class: T4, Amb. Temp.: -10 to 55°C<br>T6, Amb. Temp.: -10 to 40°C<br>Ui=31.5 V, Ii=100 mA, Pi=1.2 W, Ci=22 nF, Li=35 µH | -A |
| | **IECEx Type of protection "n"**<br>Applicable standard: IEC 60079-15:2001, IEC 60079-0:2004<br>Certificate: IECEx KEM 06.0053X<br>Ex nA [nL] IIC<br>Temp. Class: T4, Amb. Temp.: -10 to 55°C<br>T6, Amb. Temp.: -10 to 40°C<br>Ui=31.5 V, Ci=22 nF, Li=35 µH | -N |

T12E.EPS

| Item | Description | Code |
|---|---|---|
| Canadian Standards Association (CSA) | **CSA Intrinsically safe Approval**<br>Applicable standard: C22.2, No. 0-M1991, C22.2, No. 04-M2004, C22.2, No. 157-M1992, C22.2, No. 61010-1<br>Ex ia Class I, Division 1, Groups ABCD<br>Ex ia IIC<br>Temp. Class: T4, Amb. Temp.: -10 to 55°C<br>Entity { Ui(Vmax)=24 V, Ii(Imax)=250 mA, Pi(Pmax)=1.2 W, Ci=220 pF, Li=0 µH<br>FISCO { Ui(Vmax)=17.5 V, Ii(Imax)=380 mA, Pi(Pmax)=5.32 W, Ci=220 pF, Li=0 µH | -P<br>or<br>-F |
| | **CSA Non-incendive safe Approval or type of protection "n"**<br>Applicable standard: C22.2, No.0-M1991, C22.2, No.04-M2004, C22.2, No.157-M1992, C22.2, No.213-M1987, C22.2, No.61010-1<br>Class I, Division 2, Groups ABCD<br>Ex nA [nL] IIC<br>Temp. Class: T4, Amb. Temp.: -10 to 55°C<br>T6, Amb. Temp.: -10 to 40°C<br>Entity: Ui(Vmax)=32 V, Ci=220 pF, Li=0 µH<br>FNICO: Ui(Vmax)=32 V, Ci=220 pF, Li=0 µH | -B<br>or<br>-D |

CSA.EPS

mA

## NEPSI Certification (SC202S-K)

**NEPSI Intrinsically Safe Type**

Cert No. GYJ081157X

- Applicable Standard:
  GB3836.1-2000, GB3836.4-2000
- Type of Protection and Marking Code:
  Ex ia IIC T4/T6
- Ambient Temperature :
  T6; –10 to 40°C, T4; –10 to 55°C

**Note 1 Entity Parameters**

- Intrinsically safe input parameters (terminal + and -):
  Maximum Input Voltage (Ui) = 31.5 V
  Maximum Input Current (Ii) = 100 mA
  Maximum Input Power (Pi) = 1.2 W
  Maximum Internal Capacitance (Ci) = 22 nF
  Maximum Internal Inductance (Li) = 35 µH
- Intrinsically safe output parameters and maximum external parameters (terminal 11 and 16):
  Uo=14.4 V, Io=13 mA, Po=185 mW, Co=59 nF, Lo=200 mH

**Note 2 Installation**

- Electrostatic charges on the display window shall be avoided.
- The external earth connection facility shall be connected reliably.
- The instrument modification or parts replacement by other than authorized representative of Yokogawa Electric Corporation and will void NEPSI Intrinsically safe certification.
- The user shall not change the configuration in order to maintain/ensure the explosion protection performance of the equipment. Any change may impair safety.
- For installation, use and maintenance of the product, the end user shall observe the instruction manual and the following standards:
  GB50257-1996 "Code for construction and acceptance of electric device for explosion atmospheres and fire hazard electrical equipment installation engineering".

GB3836.13-1997 "Electrical apparatus for explosive gas atmospheres Part 13: Repair and overhaul for apparatus used in explosive gas atmospheres".
GB3836.15-2000 "Electrical apparatus for explosive gas atmospheres- Part 15: Electrical installations in hazardous area (other than mines)" .
GB3836.16-2006 "Electrical apparatus for explosive gas atmospheres- Part 16: Inspection and maintenance of electrical installation (other than mines)".

**mA**

**mA-HART® communication**

**A. Input** : Two wire system 4-20 mA

**B. Power supply** :
SC202G : up to 40 volts
SC202S : up to 31.5 volts
Note: The transmitter contains a switched power supply, drawing its energy from the 0-4 mA section of the signal. Consequently the 17 volt limit is applied at 4 mA. The characteristic of the unit is such that above about 7 mA on the output, the terminal voltage can drop to 14.5 volts without problem. (see figure 2-2)

**C. Transmission:** Isolated output of 4 to 20 mA DC.

**D. Signal** : Maximum load 425Ω at 24 VDC. (see figure 2-1)
Burn to signal failure acc NAMUR Recommendation NE43 (18.01.1994)

**E. Operating range :** 3.9 to 21mA

**F. Communication**
: HART®, 1200 Baud, FSK modulated on 4 to 20 mA signal

**G. Configuration** : Local with 6 keys

**H. Software :** Firmware based on Yokogawa stack.

**I. Hardware :** Yokogawa HART® Modem F9197UB

**J. Other Control systems**
: Yokogawa PRM, Rosemount AMS, Siemens PDM

**K. Hand Terminal :** Rosemount HHT 275/375

**L. Other control systems:** Yokogawa PRM, Rosemount AMS, Siemens PDM

**M. Output span** :
- Conductivity : min 0.01µS/cm, max. 1999 mS/cm.
(max 90% zero suppression)
- Resistivity : min 0.001kΩ·cm, max. 999 MΩ·cm.
(max 90% zero suppression)
The instrument is user programmable for linear or non-linear conductivity ranges.

**N. Cable specification**
: 0.5 mm diameter or 24 AWG over maximum length of 1500 m

**O. DD specification**
: The SC202 Device Description is available enabling communications with the Handheld Communicator and compatible devices.

**PROFIBUS-PA communications**

**A. Input signal:** Digital
**B. Supply voltage:** 9 to 32 V DC
**C. Operating current:** 26.0 mA
**D. Operating values:** According to IEC 1158-2
**E. Bus connection**
: Fieldbus interface base on IEC1158-2 according to FISCO-Model
**F. Power supply:** Power supply is achieved dependant on the application by means of segment coupler
**G. Data transfer:** According to PROFIBUS- PA profile class B based on EN 50170 and DIN 19245 part 4
**H. GSD file:** The actual file can be downloaded from www.profibus.com Configuration: Local with 6 keys
**I. Software:** Firmware based on Siemens DPC31 stack.
**J. Hardware:**
PC- or PCMCIA-interfaces from Siemens
**K. Other control:** Siemens PDM systems
**L Electrical connection:**
Terminals acc. to IEC 1158-2
**M. Fieldbus-cable-types:**
Twisted and shielded two wire cable according to recommendation based on IEC 1158-2 Cable diameter: 6 to 12 mm (0.24 to 0.47 inch)

**FOUNDATION FIELDBUS H1 communications**

**A. Input signal**: Digital
**B. Supply voltage**: 9 to 32 V DC
**C. Operating current**: 26.0 mA (base current)
**D. Operating values**: According to IEC 1158-2
**E. Bus connection**
: Fieldbus interface based on IEC 1158-2 according to FISCO-Model
**F. Power supply**:
Power supply is achieved dependant on application by means of segment coupler
**G. Data transfer:**
FF specification Rev. 1.4 Basic device

**H. Function blocks**:
3 x AI, Transducer, Resource

**I. Files**: Actual file can be downloaded from our homepage

**J. Configuration**: locally with 6 keys

**K. Software**: National Instruments: NI-FBUS configurator

**L. Hardware**: F-BUS interfaces from National Instruments (AT-FBUS, PCMIA-FBUS)

**M. Other control systems:**
YOKOGAWA PRM, DTM

## 2-3. Model and suffix codes

### 1. 2-wire Conductivity transmitter (General purpose)

[ Style : S3 ]

| Model | Suffix Code | Option Code | Description |
|---|---|---|---|
| SC202G | ····· | ····· | 2-wire conductivity transmitter |
| Type | -A | ····· | mA with HART |
| | -P | ····· | Profibus |
| | -F | ····· | FF |
| Language | -J | ····· | Japanese |
| | -E | ····· | English |
| Option Mounting Hardware | | /U | Pipe, wall mounting bracket (Stainless steel) |
| | | /PM | Panel mounting bracket (Stainless steel) |
| Hood | | /H | Hood for sun protection (Carbon steel) |
| | | /H2 | Hood for sun protection (Stainless steel) |
| Tag Plate | | /SCT | Stainless steel tag plate |
| Conduit Adapter | | /AFTG | G1/2 |
| | | /ANSI | 1/2NPT |
| | | /TB | Screw terminal (*1) |
| | | /X1 | Epoxy baked finish (*2) |

(*1) It can be specified when the suffix code -A is selected.

(*2) The housing is coated with epoxy resin.

### 2. 2-wire Conductivity transmitter (Explosionproof type)

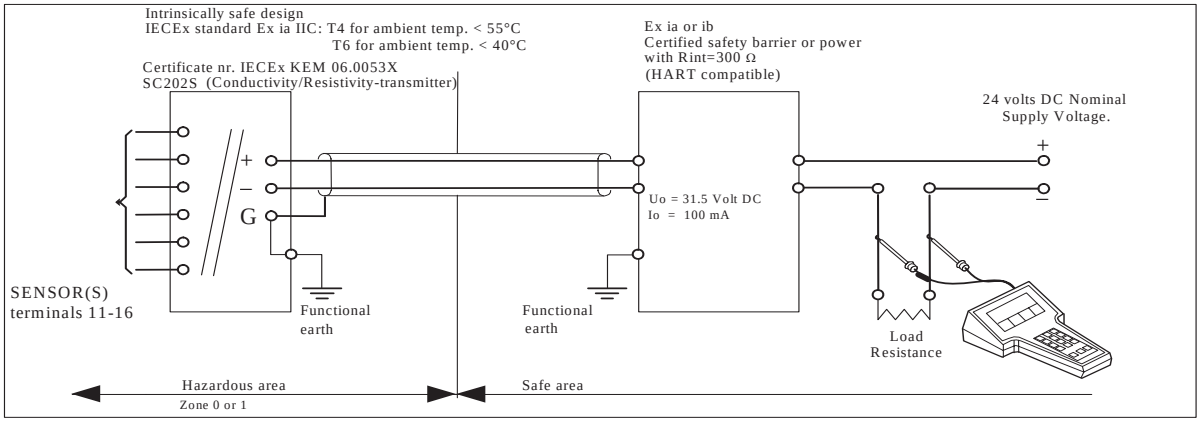
[ Style : S3 ]

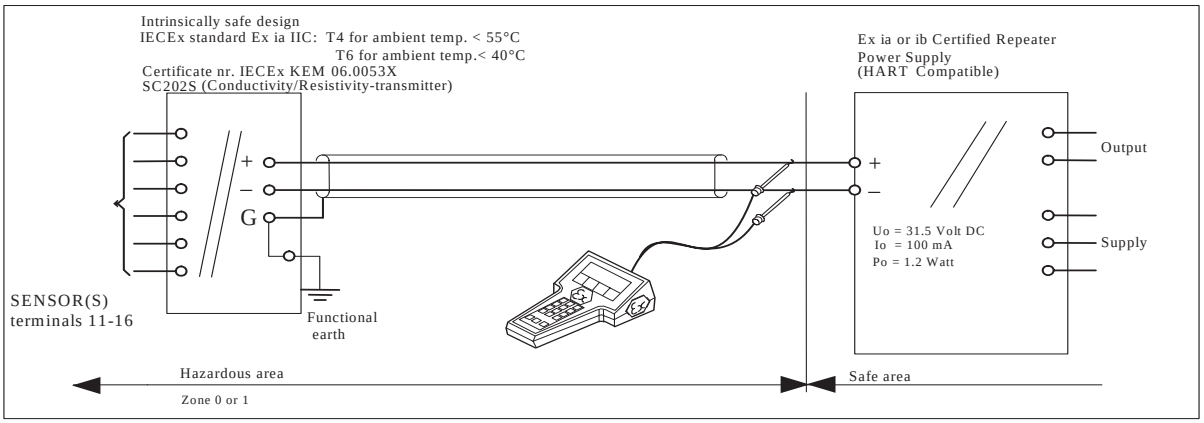
| Model | Suffix Code | Option Code | Description |
|---|---|---|---|
| SC202S | ····· | ····· | 2-wire conductivity transmitter |
| Type | -A | ····· | Intrinsic safe mA with HART (ATEX, CSA, FM) |
| | -K | ····· | Intrinsic safe mA with HART (NEPSI) |
| | -P | ····· | Intrinsic safe Profibus (ATEX, CSA, FM) |
| | -F | ····· | Intrinsic safe FF (ATEX, CSA, FM) |
| | -B | ····· | Non-incendive FF (ATEX, CSA, FM) (*2) |
| | -N | ····· | Non-incendive mA with HART (ATEX, CSA, FM) (*2) |
| | -D | ····· | Non-incendive Profibus (ATEX, CSA, FM) (*2) |
| Language | -J | ····· | Japanese |
| | -E | ····· | English |
| Option Mounting Hardware | | /U | Pipe, wall mounting bracket (Stainless steel) |
| | | /PM | Panel mounting bracket (Stainless steel) |
| Hood | | /H | Hood for sun protection (Carbon steel) |
| | | /H2 | Hood for sun protection (Stainless steel) |
| Tag Plate | | /SCT | Stainless steel tag plate |
| Conduit Adapter | | /AFTG | G1/2 |
| | | /ANSI | 1/2NPT |
| | | /X1 | Epoxy baked finish (*1) |

(*1) The housing is coated with epoxy resin.

(*2) When the instrument with Suffix Code "-B,-N,-D" is used, take measures so that the display window is not exposed to direct sunlight.

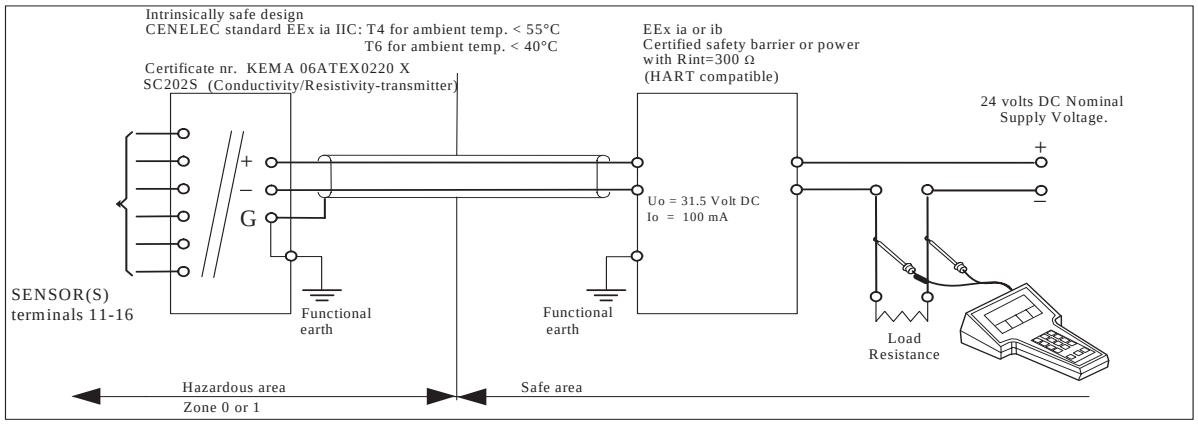
**2-4. Control Drawing SC202S mA HART® Specification (IECEx)**

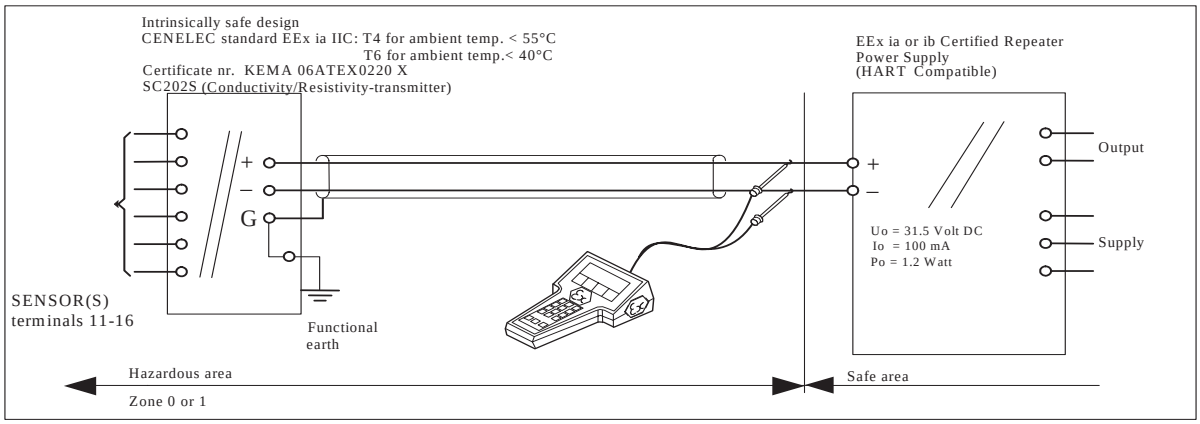



- Sensor(s) are of a passive type to be regarded as 'simple apparatus'.
- Electrical data of the SC202S.
  - Supply and output circuit (terminals + and -):
    Maximum input voltage $U_i$ = 31.5 V. Maximum input current $I_i$ = 100 mA.
    Maximum input power $P_i$ = 1.2 W.
    Effective internal capacitance $C_i$ = 22 nF.
    Effective internal inductance $L_i$ = 35 μH.
  - Sensor input circuit (terminals 11 through 16):
    Maximum output voltage $U_o$ = 14.4 V. Maximum output current $I_o$ = 13 mA.
    Maximum allowed external capacitance Co = 59 nF (for SC202S-A),
    Co = 2.9 μF (for SC202S-N).
    Maximum allowed external inductance Lo = 200 mH (for SC202S-A),
    Lo = 450 mH (for SC202S-N).
- Barriers and power supply specification must not exceed the maximum values as shown in the diagram above. These safety descriptions cover most of the commonly used industry standard barriers, isolators and power supplies.
- The Hand Held Communicator must be of a IECEx certified intrinsically safe type in case it is used on the intrinsically safe circuit in the hazardous area or of a IECEx certified non-incendive type in case it is used in the non-incendive circuit in the hazardous area.

## 2-5. Control Drawing SC202S mA HART® Specification (ATEX)




- Sensor(s) are of a passive type to be regarded as 'simple apparatus'.
- Electrical data of the SC202S.
  - Supply and output circuit (terminals + and -):
    Maximum input voltage $U_i$ = 31.5 V. Maximum input current $I_i$ = 100 mA.
    Maximum input power $P_i$ = 1.2 W.
    Effective internal capacitance $C_i$ = 22 nF.
    Effective internal inductance $L_i$ = 35 μH.
  - Sensor input circuit (terminals 11 through 16):
    Maximum output voltage $U_o$ = 14.4 V. Maximum output current $I_o$ = 13 mA.
    Maximum allowed external capacitance Co = 59 nF (for SC202S-A),
    Co = 2.9 uF (for SC202S-N).
    Maximum allowed external inductance Lo = 200 mH (for SC202S-A),
    Lo = 450 mH (for SC202S-N).
- Barriers and power supply specification must not exceed the maximum values as shown in the diagram above. These safety descriptions cover most of the commonly used industry standard barriers, isolators and power supplies.
- The Hand Held Communicator must be of a ATEX certified intrinsically safe type in case it is used on the intrinsically safe circuit in the hazardous area or of a ATEX certified non-incendive type in case it is used in the non-incendive circuit in the hazardous area.

## 2-6. Control Drawing SC202S mA HART® Specification (FM Intrinsically safe design).

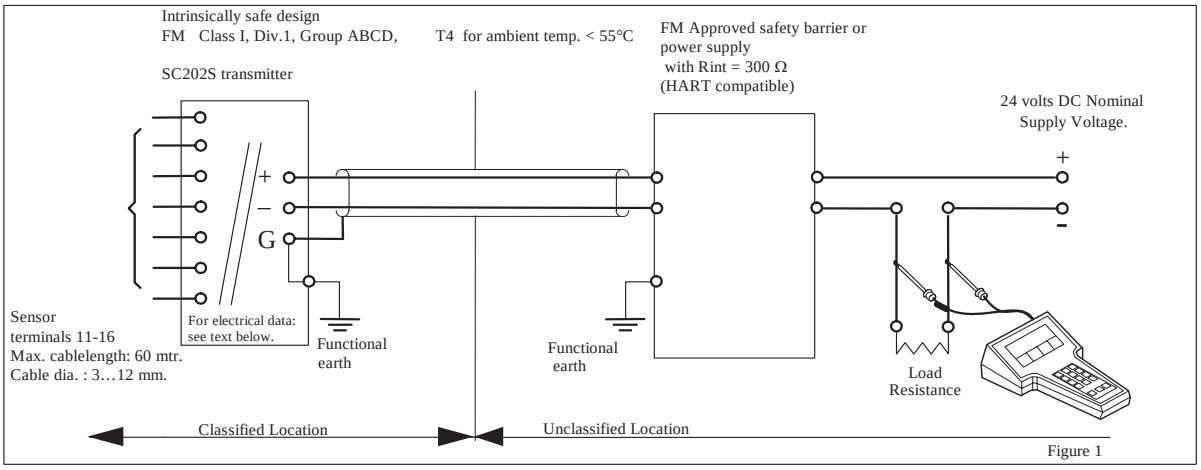



Figure 1

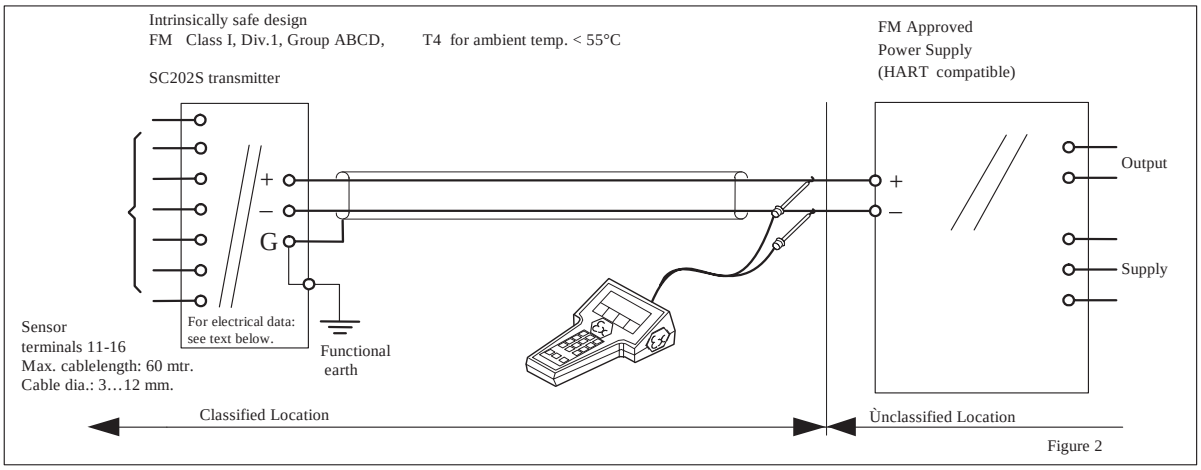



Figure 2

・Electrical data of the SC202S.

- Supply circuit (terminals + and ):

Maximum input voltage Vmax = 31.5 V. Maximum input current Imax = 100 mA.
Maximum input power Pmax = 1.2 W.
Effective internal capacitance Ci = 22 nF. Effective internal inductance Li = 35 μH.

- Sensor input circuit (terminals 11 through 16) :

Maximum output voltage Vt = 14.4 V. Maximum output current It = 10 mA.
Maximum allowed external capacitance Ca = 59.36 nF.
Maximum allowed external inductance La = 340 mH.

・If Hand Held Terminal (HHT) is not connected to the power supply lines of the SC202S (see figure 1):

Any FM Approved barrier or power supply may be used that meets the following requirements.
Voc or Vt ≤ 31.5 V ; Isc or It ≤ 100 mA; Ca ≥ 22nF + Ccable ; La ≥ 35μH + Lcable

If HHT is connected to the power supply lines of the SC202S (see figure 2):

The Hand Held Terminal must be FM Approved. Refer to the manufacturers control drawing of the HHT and the barrier/power supply to determine the cable parameters.

(Voc or Vt ) + VHHT ≤ 31.5 V; (Isc or It ) + IHHT ≤ 100 mA;
Ca ≥ 22nF + Ccable+ CHHT ; La ≥ 35μH + Lcable+ LHHT

When installing this equipment, follow the manufacturer's installation drawing.

Installation should be in accordance with ANSI/ISA RP 12.06.01 "Installation of Intrinsically Safe Systems for Hazardous (Classified) Locations" and the National Electrical Code (ANSI/NFPA 70).

Control equipment connected to the barrier/power supply must not use or generate more than 250 Vrms or Vdc.

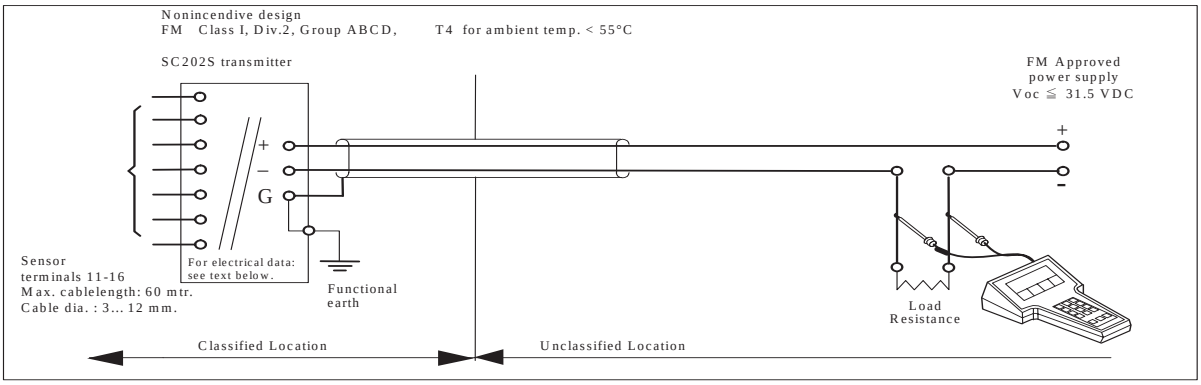
・ Resistance between Intrinsically Safe Ground and earth ground must be less than 1.0 Ohm.

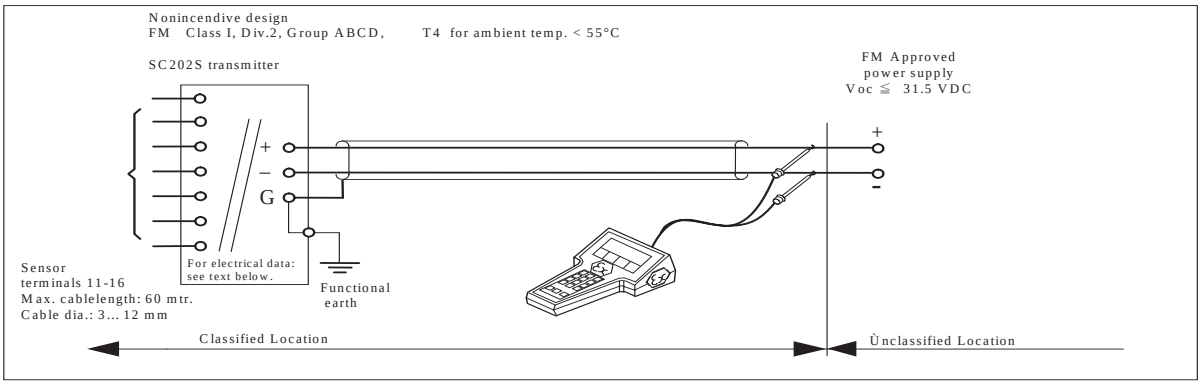
・ In case of using cable glands in Outdoor location, they shall be UV rated or made of metal.

WARNING

- Substitution of components may impair Intrinsic Safety
- To prevent ignition of flammable or combustible atmospheres, disconnect power before servicing or read, understand and adhere to the manufacturer's'live maintenance procedures.

## 2-7. Control Drawing SC202S mA HART® Specification (FM Non-incendive design)




・Electrical data of the SC202S.
- Supply circuit (terminals + and -):
  Maximum input voltage Vmax = 31.5 V. Maximum input power Pmax = 1.2 W
  Effective internal capacitance Ci = 22 nF Effective internal inductance Li = 35 µH
- Sensor input circuit (terminals 11 through 16):
  Maximum output voltage Vt = 14.4 V. Maximum output current It = 10 mA.
  Maximum allowed external capacitance Ca = 1.71 µF.
  Maximum allowed external inductance La = 600 mH.

・The Hand Held Terminal must be FM Approved in case it is used in the classified location.
When installing this equipment, follow the manufacturers installation drawing.
Installation shall be in accordance with Article 501.4(B) of the National Electrical Code.
Non-incendive field wiring may be installed in accordance with Article 501 of the National Electrical Code.

・ Grounding shall be in accordance with Article 250 of the National Electrical code
・ In case of using cable glands in Outdoor location, they shall be UV rated or made of metal.

WARNING
- Substitution of components may impair suitability for Division 2
- Do not remove or replace while circuit is live unless area is know to be non-hazardous
- Explosion Hazard – Do not disconnect equipment unless area is know to be non-hazardous
- Do not reset circuit breaker unless power has been removed from the equipment or the area is know to be non-hazardous

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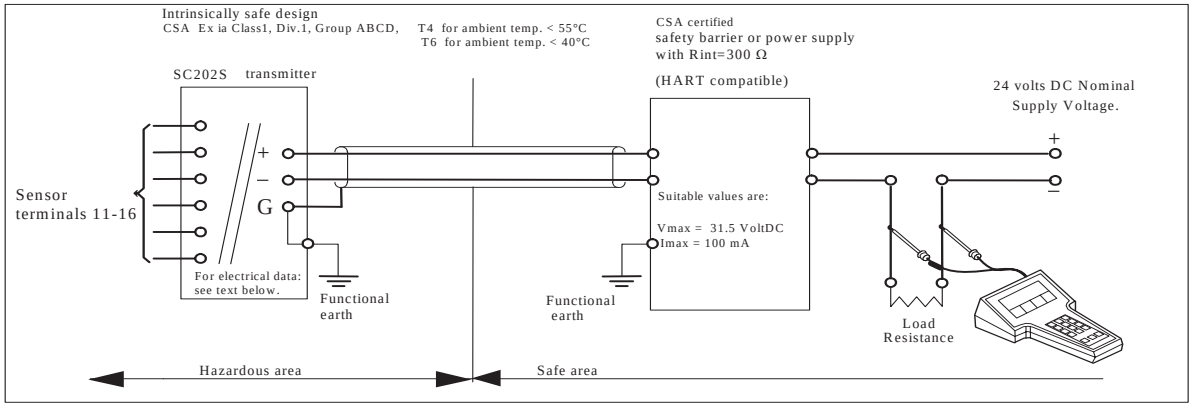
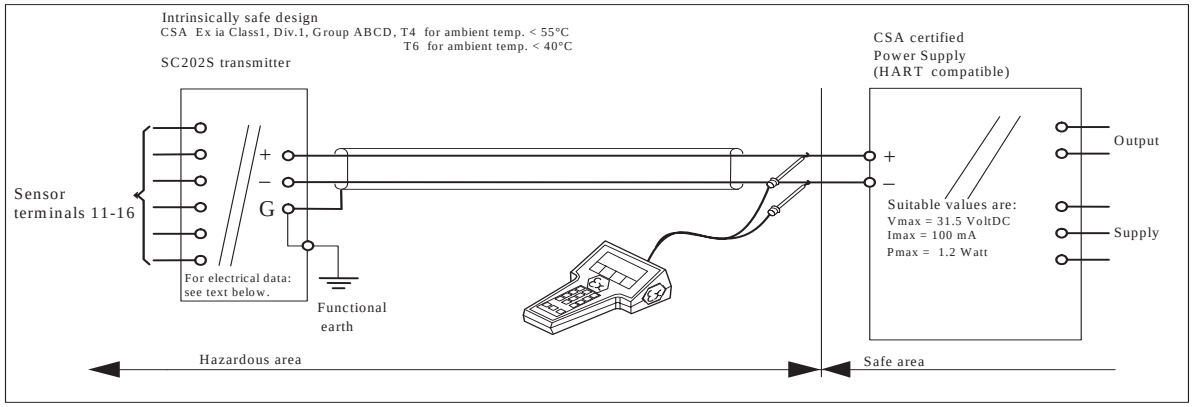
## 2-8. Control Drawing of SC202S mA HART® Specification (CSA)



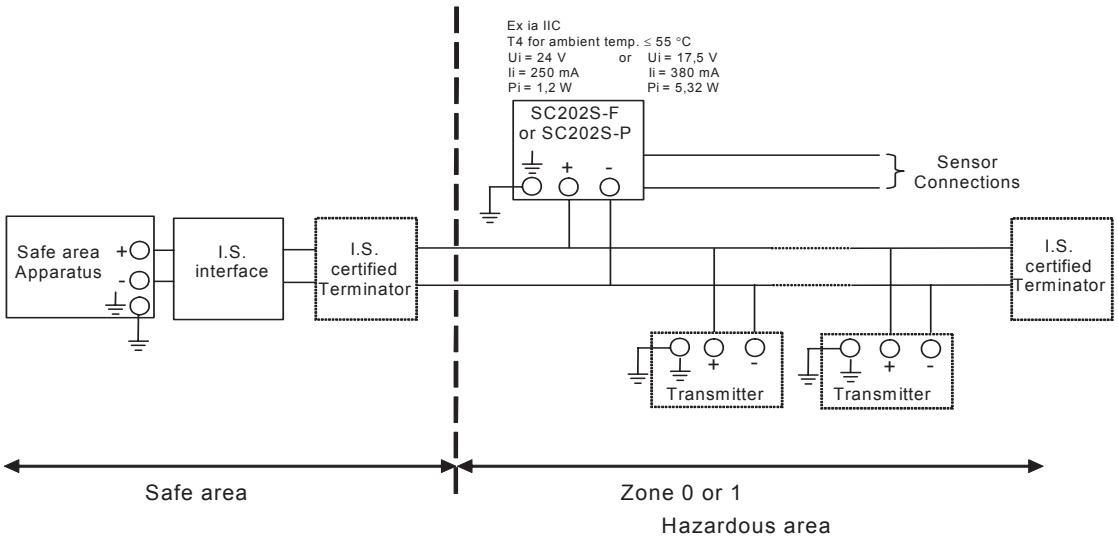

- Sensor is a thermocouples, RTD's, passive resistive switch devices, or is CSA entity approved and meet connection requirements.

- Electrical data of the SC202S.
  - Supply and output circuit (terminals + and -)
    Maximum input voltage Vmax = 31.5 V. Maximum input current Imax = 100 mA.
    Maximum input power Pmax = 1.2 W.
    Effective internal capacitance Ci = 22 nF. Effective internal inductance Li = 35 μH.
  - Sensor input circuit (terminals 11 through 16):
    Maximum output voltage Voc = 14.4 V. Maximum output current Isc = 13 mA.
    Maximum allowed external capacitance Ca = 59 nF.
    Maximum allowed external inductance La = 200 mH.

- Barriers and power supply should be CSA certified. The specifications must not exceed the maximum values as shown in the diagram above. Installation should be in accordance with Canadian Electrical Code, Part I.
  Maximum safe area voltage should not exceed 250 VRMS.
  For Class I, Div. 2, Group ABCD the CSA certified barrier is not required, and the Sensor input circuit (terminals 11 through 16) is non-incendive having the parameters :
  Maximum output voltage Voc = 14.4 V. Maximum output current Isc = 13 mA.
  Maximum allowed external capacitance Ca = 2.9 μF.
  Maximum allowed external inductance La = 450 mH.

- The Hand Held Communicator must be of a CSA certified intrinsically safe type in case it is used on the intrinsically safe circuit in the hazardous area, or of a CSA certified non-incendive type in case it is used on the non-incendive circuit in the hazardous area.

## 2-9. Control Drawing of SC202S FF/PB Specification (IECEx)




- Sensor(s) are of a passive type to be regarded as 'simple apparatus'.

- Electrical data of the SC202S-F & SC202S-P:
  - Supply and output circuit:
    Maximum input voltage Ui= 24 V
    Maximum input current Ii= 250 mA
    Maximum input power Pi= 1.2 W
    Effective internal capacitance Ci= 220 pF;
    Effective internal inductance Li= 0 µH.

  or

    FISCO field device
    Maximum input voltage Ui= 17.5 V
    Maximum input current Ii= 380 mA
    Maximum input power Pi= 5.32 W
    Effective internal capacitance Ci= 220 pF;
    Effective internal inductance Li= 0 µH.

  - Sensor input circuit:
    Maximum output voltage Uo= 14.4 V; Maximum output current Io= 13 mA
    Maximum allowed external capacitance Co= 59 nF
    Maximum allowed external inductance Lo= 200 mH

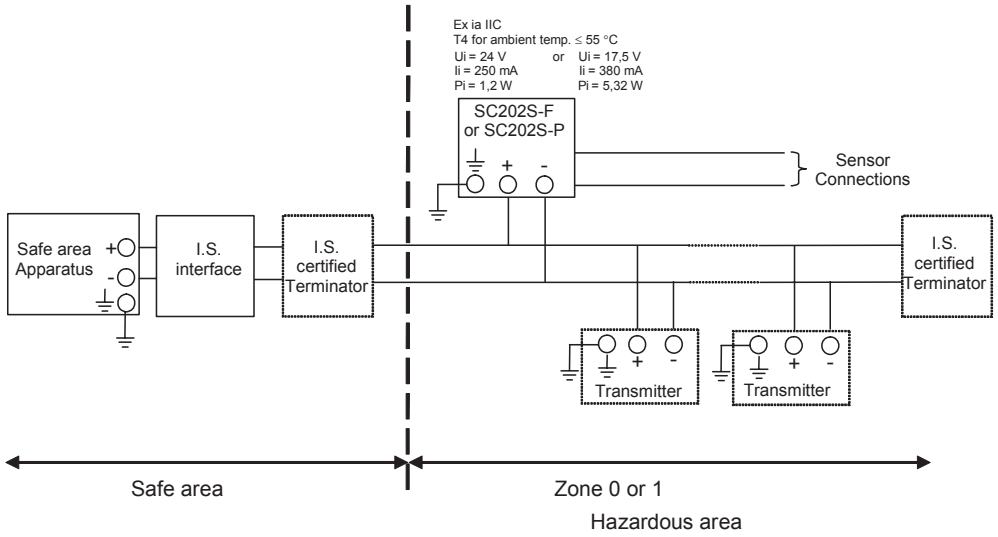
- Any I.S. interface may be used that meets the following requirements:
    Uo ≤ 24 V
    Io ≤ 250 mA
    Po ≤ 1.2 W
    Ca ≥ 220 pF + Ccable; La ≥ 0 µH + Lcable

  or

    FISCO power supply
    Uo ≤ 17.5 V
    Io ≤ 380 mA
    Po ≤ 5.32 W
    Ca ≥ 220 pF + Ccable; La ≥ 0 µH + Lcable

- Electrical data of the SC202S-B & SC202S-D (Type of protection “n”)
  - Supply and output circuit:
    Maximum input voltage Ui = 32 V
    Effective internal capacitance Ci = 220 pF; Effective internal inductance Li = 0 µH.
  - Sensor input circuit:
    Maximum output voltage Uo= 14.4 V; Maximum output current Io= 13 mA
    Maximum allowed external capacitance Co = 2.9 µF
    Maximum allowed external inductance Lo = 450 mH

## 2-10. Control Drawing of SC202S FF/PB Specification (ATEX)




- Sensor(s) are of a passive type to be regarded as 'simple apparatus'.

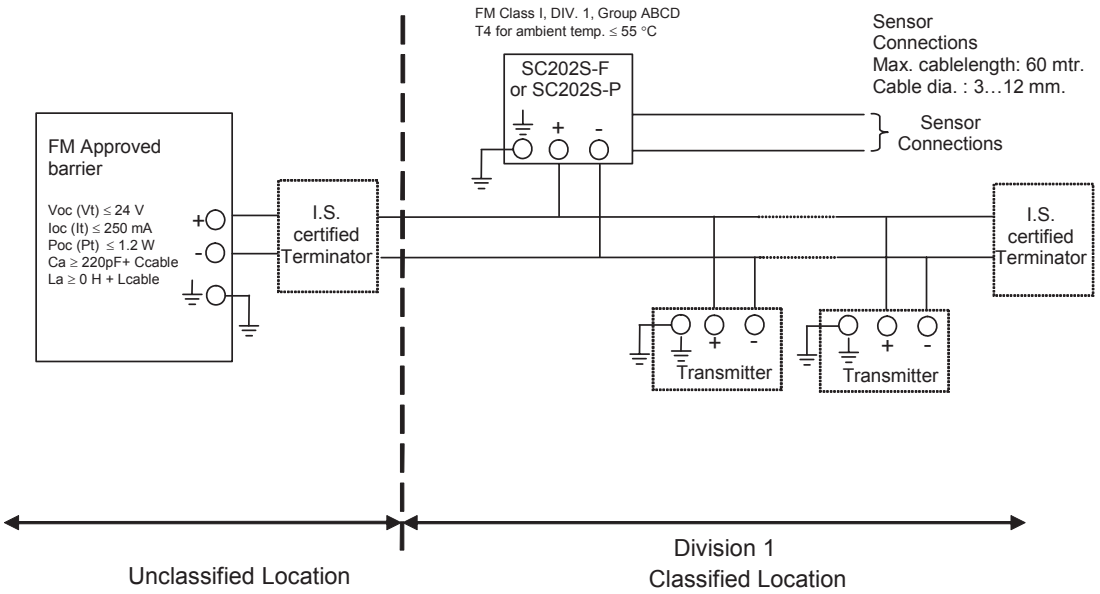
- Electrical data of the SC202S-F & SC202S-P:
  - Supply and output circuit:
    Maximum input voltage Ui= 24 V
    Maximum input current Ii= 250 mA
    Maximum input power Pi= 1.2 W
    Effective internal capacitance Ci= 220 pF;
    Effective internal inductance Li= 0 µH.
  or
    FISCO field device
    Maximum input voltage Ui= 17.5 V
    Maximum input current Ii= 380 mA
    Maximum input power Pi= 5.32 W
    Effective internal capacitance Ci= 220 pF;
    Effective internal inductance Li= 0 µH.

  - Sensor input circuit:
    Maximum output voltage Uo= 14.4 V; Maximum output current Io= 13 mA
    Maximum allowed external capacitance Co= 59 nF
    Maximum allowed external inductance Lo= 200 mH

- Any I.S. interface may be used that meets the following requirements:
    Uo ≤ 24 V
    Io ≤ 250 mA
    Po ≤ 1.2 W
    Ca ≥ 220 pF + Ccable; La ≥ 0 µH + Lcable
  or
    FISCO power supply
    Uo ≤ 17.5 V
    Io ≤ 380 mA
    Po ≤ 5.32 W
    Ca ≥ 220 pF + Ccable; La ≥ 0 µH + Lcable

- Electrical data of the SC202S-B & SC202S-D (Type of protection “n”)
  - Supply and output circuit:
    Maximum input voltage Ui = 32 V
    Effective internal capacitance Ci= 220 pF; Effective internal inductance Li= 0 µH.
  - Sensor input circuit:
    Maximum output voltage Uo=14.4V; Maximum output current Io= 13 mA
    Maximum allowed external capacitance Co = 2.9 µF
    Maximum allowed external inductance Lo = 450 mH

## 2-11. Control Drawing of SC202S FF/PB Specification (FM Intrinsically safe Entity)




- Sensor(s) are of a passive type to be regarded as 'simple apparatus', devices which neither store nor generate voltages over 1.5 V, currents over 0.1 A, power over 25 mW or energy over 20 μJ, or are FM Approvals entity approved and meet connection requirements.

- Electrical data of the SC202S-F & SC202S-P:
  - Supply circuit:
    Maximum input voltage Vmax= 24 V
    Maximum input current Imax= 250 mA
    Maximum input power Pi= 1.2 W
    Effective internal capacitance Ci = 220 pF;
    Effective internal inductance Li = 0 μH.
  - Sensor input circuit:
    Maximum output voltage Vt= 14.4 V; Maximum output current It= 10 mA
    Maximum allowed external capacitance Ca= 59.36 nF
    Maximum allowed external inductance La= 340 mH

- Any FM Approved barrier may be used that meets the following requirements:
  Voc or Vt ≤ 24 V
  Ioc or It ≤ 250 mA
  Poc or Pt ≤ 1.2 W
  Ca ≥ 220 pF + Ccable; La ≥ 0 μH + Lcable

  When installing this equipment, follow the manufacturer's installation drawing.
  Installation should be in accordance with ANSI/ISA RP 12.06.01 "Installation of Intrinsically Safe Systems for Hazardous (Classified) Locations" and the National Electrical Code (ANSI/NFPA 70).
  Associated apparatus connected to the barrier must not use or generate more than 250 Vrms or Vdc.

- Resistance between Intrinsically Safe Ground and earth ground must be less than 1.0 Ohm.
- In case of using cable glands in Outdoor location, they shall be UV rated or made of metal.

  WARNING
  - Substitution of components may impair Intrinsic Safety
  - To prevent ignition of flammable or combustible atmospheres, disconnect power before servicing or read, understand and adhere to the manufacturer's live maintenance procedures.

- The cable used to interconnect the devices needs to comply with the following parameters:
  Loop resistance R': 15 ... 150 Ω/km; Inductance per unit length L': 0,4 ... 1 mH/km
  Capacitance per unit length C': 80 ... 200 nF/km
  (C' = C' line/line + 0,5 C' line/screen if both line are floating)
  (C' = C' line/line + C' line/screen if the screen is connected to one line)
  Length of spur cable: max. 30 m
  Length of trunk cable: max. 1 km
  Length of splice : max. 1 m

  WARNING
  - Substitution of components may impair Intrinsic Safety
  - To prevent ignition of flammable or combustible atmospheres, disconnect power before servicing or read, understand and adhere to the manufacturer's live maintenance procedures.

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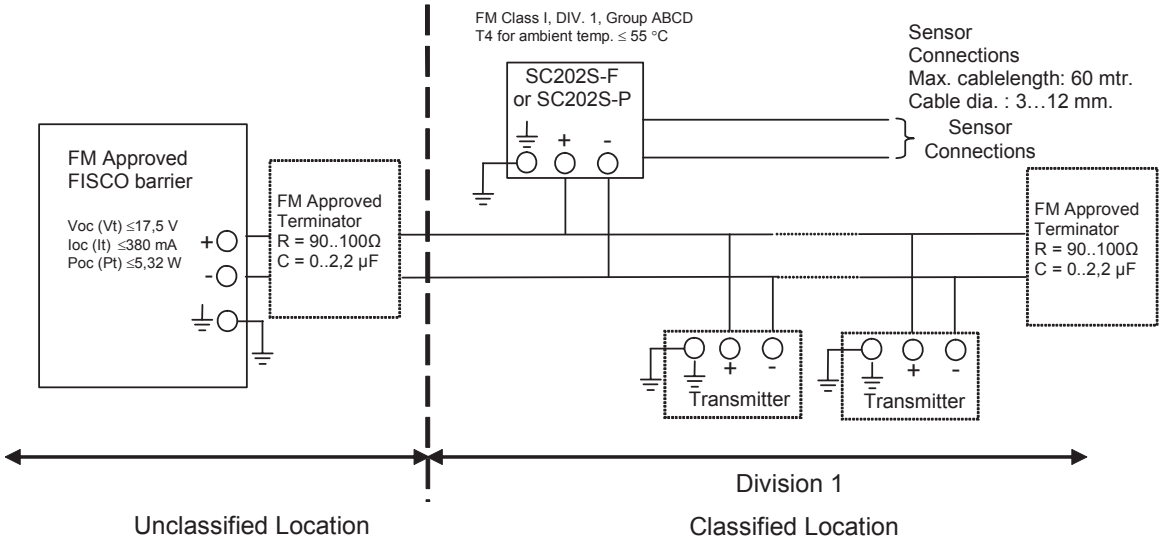
**2-12. Control Drawing of SC202S FF/PB Specification (FM Intrinsically safe FISCO)**




- Sensor(s) are of a passive type to be regarded as 'simple apparatus', devices which neither store nor generate voltages over 1.5 V, currents over 0.1 A, power over 25 mW or energy over 20 μJ, or are FM Approvals entity approved and meet connection requirements.

- Electrical data of the SC202S-F & SC202S-P:
  - Supply circuit: Vmax = 17.5 V; Imax = 380 mA; Pi = 5.32 W; Ci = 220 pF; Li = 0 μH.
  - Sensor input circuit: Vt = 14.4 V; It = 10 mA; Ca = 59.36 nF; La = 340 mH

- Any FM Approved FISCO barrier may be used that meets the following requirements:
  Voc or Vt ≤ 17.5 V; Ioc or It ≤ 380 mA; Poc or Pt ≤ 5.32 W
  When installing this equipment, follow the manufacturer's installation drawing.
  Installation should be in accordance with ANSI/ISA RP 12.06.01 "Installation of Intrinsically Safe Systems for Hazardous (Classified) Locations" and the National Electrical Code (ANSI/NFPA 70).
  Associated apparatus connected to the FISCO barrier must not use or generate more than 250 Vrms or Vdc.

- Resistance between FISCO Intrinsically Safe Ground and earth ground must be less than 1.0 Ohm.
- In case of using cable glands in Outdoor location, they shall be UV rated or made of metal.

- The FISCO concept allows the interconnection of several I.S. apparatus not specifically examined in such combination. The criterion for such interconnection is that the voltage (Vmax), the current (Imax) and the power (Pi) which I.S. apparatus can receive and remain intrinsically safe, considering faults, must be equal to or greater that the voltage (Voc, Vt), the current (Ioc, It) and the power (Poc, Pt) which can be providede by the FM approved FISCO barrier. In addition, the maximum unprotected residual capacitance (Ci) and inductance (Li) of each apparatus (other than the terminator) connected to the Fieldbus must be less than or equal to 5nF and 10 μH respectively.

- In each I.S. Fieldbus segment only one active source, normally the FM Approved FISCO barrier, is allowed to provide the necessary power for the Fieldbus system. All other equipment connected to the bus cable has to be passive (not providing energy to the system), except to a leakage current of 50μA for each connected device. Seperately powered equipment needs a galvanic isolation to insure that the I.S. Fieldbus circuit remains passive.

- The cable used to interconnect the devices needs to comply with the following parameters:
  Loop resistance R': 15 ... 150 Ω/km; Inductance per unit length L': 0,4 ... 1 mH/km
  Capacitance per unit length C': 80 ... 200 nF/km
  (C' = C' line/line + 0,5 C' line/screen if both line are floating)
  (C' = C' line/line + C' line/screen if the screen is connected to one line)
  Length of spur cable: max. 30 m
  Length of trunk cable: max. 1 km
  Length of splice : max. 1 m

WARNING
- Substitution of components may impair Intrinsic Safety
- To prevent ignition of flammable or combustible atmospheres, disconnect power before servicing or read, understand and adhere to the manufacturer's live maintenance procedures.

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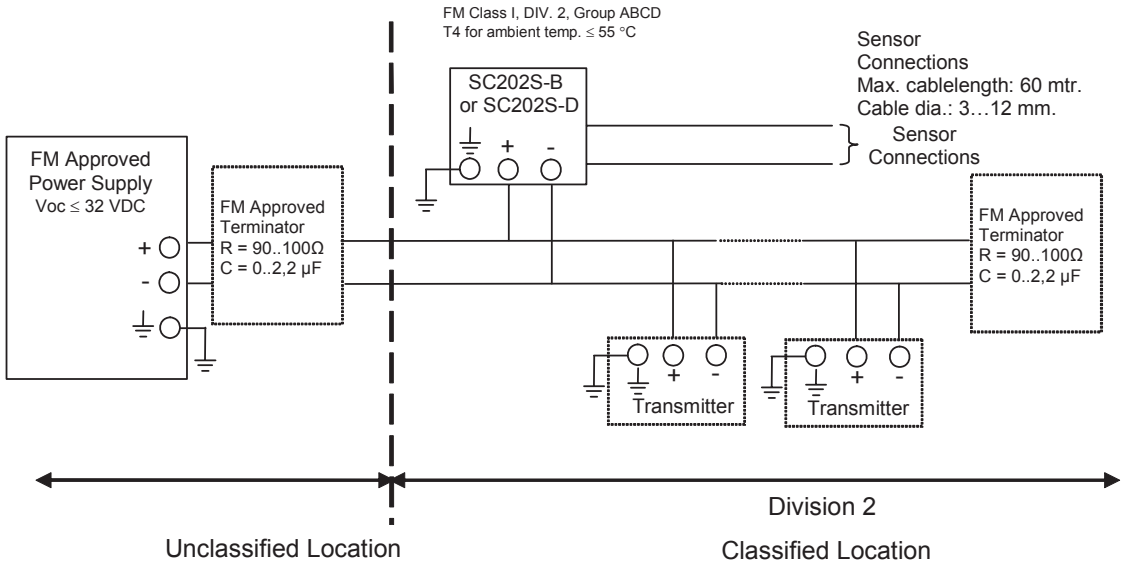
## 2-13. Control Drawing of SC202S FF/PB Specification (FM Non-incendive Entity)




- Sensor(s) are of a passive type to be regarded as 'simple apparatus', devices which neither store nor generate voltages over 1.5 V, currents over 0.1 A, power over 25 mW or energy over 20 µJ, or are FM Approvals entity approved and meet connection requirements.

- Electrical data of the SC202S-B & SC202S-D:
  - Supply circuit: Vmax= 32 V; Pi= 1.2 W; Ci= 220 pF; Li= 0 µH
  - Sensor input circuit: Vt= 14.4 V; It= 10 mA; Ca= 1.71 µF; La= 600 mH

  When installing this equipment, follow the manufacturers installation drawing.
  Installation shall be in accordance with Article 501.4(B) of the National Electrical Code (ANSI/NFPA 79). Nonincendive field wiring may be installed in accordance with Article 501.4(B)(3)

- Grounding shall be in accordance with Article 250 of the National Electrical code.
- In case of using cable glands in Outdoor location, they shall be UV rated or made of metal.

WARNING
- Substitution of components may impair suitability for Division 2.
- Do not remove or replace while circuit is live unless area is know to be non-hazardous
- Explosion Hazard – Do not disconnect equipment unless area is know to be non-hazardous
- Do not reset circuit breaker unless power has been removed from the equipment or the area is know to be non-hazardous

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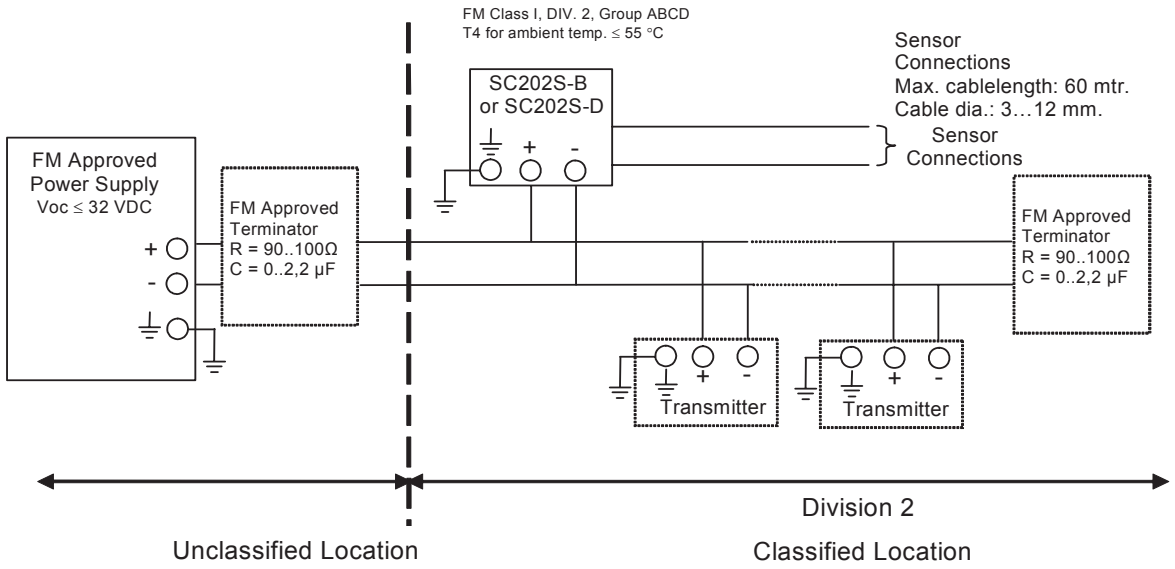
## 2-14. Control Drawing of SC202S FF/PB Specification (FM Non-incendive FNICO)




- Sensor(s) are of a passive type to be regarded as 'simple apparatus', devices which neither store nor generate voltages over 1.5 V, currents over 0.1 A, power over 25 mW or energy over 20 μJ, or are FM Approvals entity approved and meet connection requirements.
- Electrical data of the SC202S-B & SC202S-D:
  - Supply circuit: Vmax= 32 V; Pi= 5.32 W; Ci= 220 pF; Li= 0 μH
  - Sensor input circuit: Vt= 14.4 V; It= 10 mA; Ca = 1.71 µF; La = 600 mH

  When installing this equipment, follow the manufacturers installation drawing.
  Installation shall be in accordance with Article 501.4(B) of the National Electrical Code (ANSI/NFPA 79).
  Non-incendive field wiring may be installed in accordance with Article 501.4(B)(3)

- Grounding shall be in accordance with Article 250 of the National Electrical code.
- In case of using cable glands in Outdoor location, they shall be UV rated or made of metal.

WARNING
- Substitution of components may impair suitability for Division 2.
- Do not remove or replace while circuit is live unless area is know to be non-hazardous
- Explosion Hazard – Do not disconnect equipment unless area is know to be non-hazardous
- Do not reset circuit breaker unless power has been removed from the equipment or the area is know to be non-hazardous

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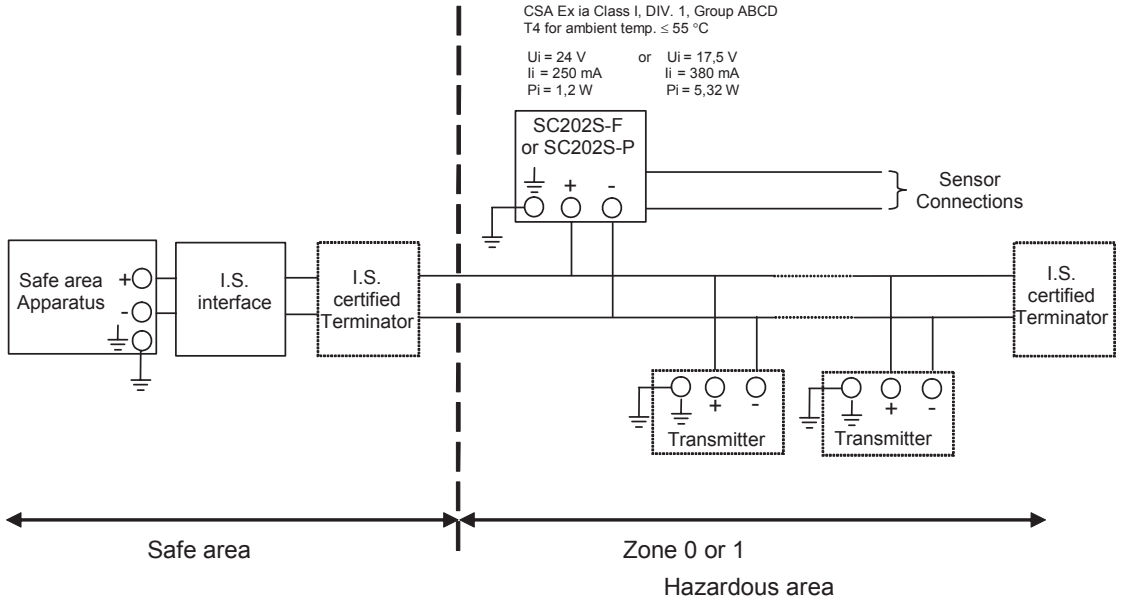
## 2-15. Control Drawing of SC202S FF/PB Specification (CSA)




- Sensor(s) are a thermocouple, RTD's, passive resistive switch devices, or is CSA entity approved and meet connection requirements.
- Electrical data of the SC202S-F & SC202S-P:
  - Supply and output circuit:
    Maximum input voltage Ui = 24 V
    Maximum input current Ii = 250 mA
    Maximum input power Pi = 1.2 W
    Effective internal capacitance Ci = 220 pF; Effective internal inductance Li = 0 µH.

  or

    FISCO field device
    Maximum input voltage Ui = 17.5 V
    Maximum input current Ii = 380 mA
    Maximum input power Pi = 5.32 W
    Effective internal capacitance Ci = 220 pF;
    Effective internal inductance Li = 0 µH.
  - Sensor input circuit:
    Maximum output voltage Uo = 14.4 V; Maximum output current Io = 13 mA
    Maximum allowed external capacitance Co = 59 nF
    Maximum allowed external inductance Lo = 200 mH
- Any CSA approved I.S. interface may be used that meets the following requirements:
    Uo ≤ 24 V
    Io ≤ 250 mA
    Po ≤ 1.2 W
    Co ≥ 220 pF + Ccable; Lo ≥ 0 µH + Lcable

  or

    FISCO field device
    Uo ≤ 17.5 V
    Io ≤ 380 mA
    Po ≤ 5.32 W
    Co ≥ 220 pF + Ccable; Lo ≥ 0 µH + Lcable

  Installation should be in accordance with Canadian Electrical Code, Part I or CEC, Part I.
  Maximum safe area voltage should not exceed 250 Vrms.

- Electrical data of the SC202S-B & SC202S-D (non-incendive):
  For Class I, Div.2, Group ABCD the CSA approved I.S. interface is not required, and the sensor input circuit is non-incendive having the parameters:
    Maximum output voltage Uo = 14.4 V; Maximum output current Io = 13 mA
    Maximum allowed external capacitance Co = 2.9 µF
    Maximum allowed external inductance Lo = 450 mH

## 3. INSTALLATION AND WIRING

### 3-1. Installation and dimensions

#### 3-1-1. Installation site

The EXA transmitter is weatherproof and can be installed inside or outside. It should, however, be installed as close as possible to the sensor to avoid long cable runs between sensor and transmitter. In any case, the cable length should not exceed 60 meters (200 feet). Select an installation site where:

- Mechanical vibrations and shocks are negligible
- No relay/power switches are in the direct environment
- Access is possible to the cable glands (see figure 3-1)
- The transmitter is not mounted in direct sunlight or severe weather conditions
  When the instrument with Suffix Code "-B,-N,-D" is used, take measures so that the display window is not exposed to direct sunlight
- Maintenance procedures are possible (avoiding corrosive environments)

The ambient temperature and humidity of the installation environment must be within the limits of the instrument specifications. (See chapter 2).

#### 3-1-2. Mounting methods

Refer to figures 3-2 and 3-3. Note that the EXA transmitter has universal mounting capabilities:

- Panel mounting using optinal bracket, refer to Fig. 3-2a.
- Panel mounting using two (2) self-tapping screws, refer to Fig. 3-2b.
- Surface mounting on a plate (using bolts from the back)
- Wall mounting on a bracket (for example, on a solid wall)
- Pipe mounting using a bracket on a horizontal or vertical pipe (nominal pipe diameter JIS 50A)

Unit: mm (inch)

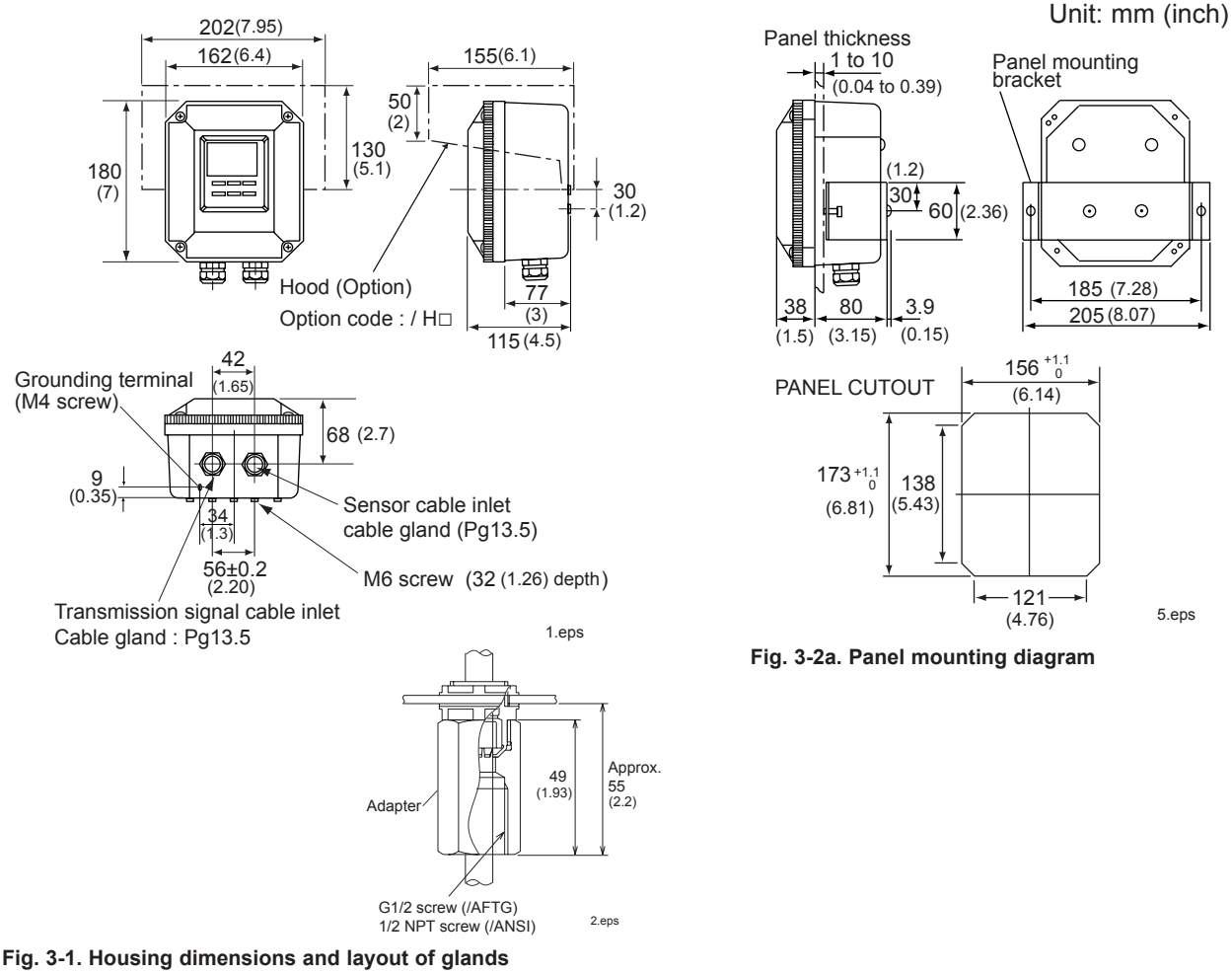



**Fig. 3-1. Housing dimensions and layout of glands**




**Fig. 3-2a. Panel mounting diagram**

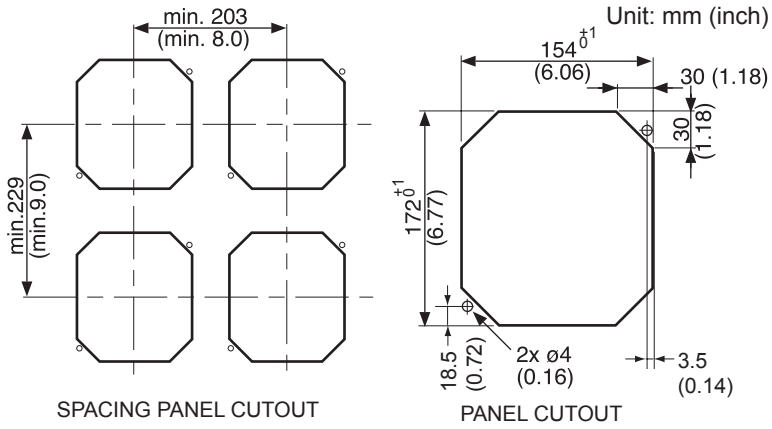



**Fig. 3-2b. Panel mounting using two (2) self-tapping screws**

Unit: mm (inch)

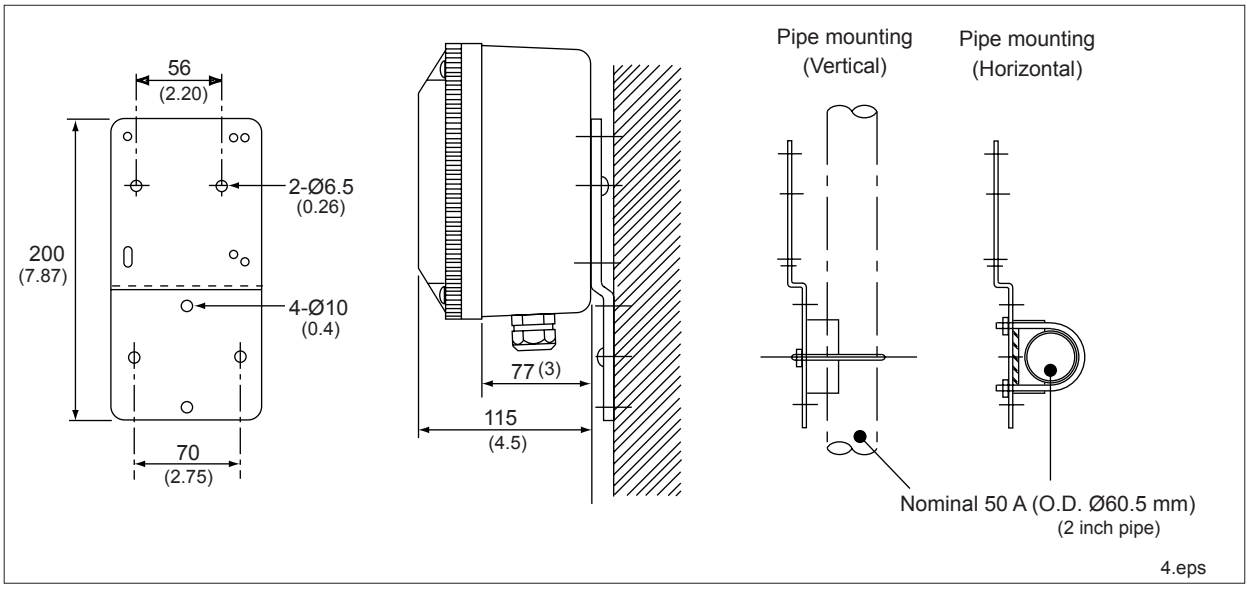



**Figure 3-3. Wall and pipe mounting diagram**

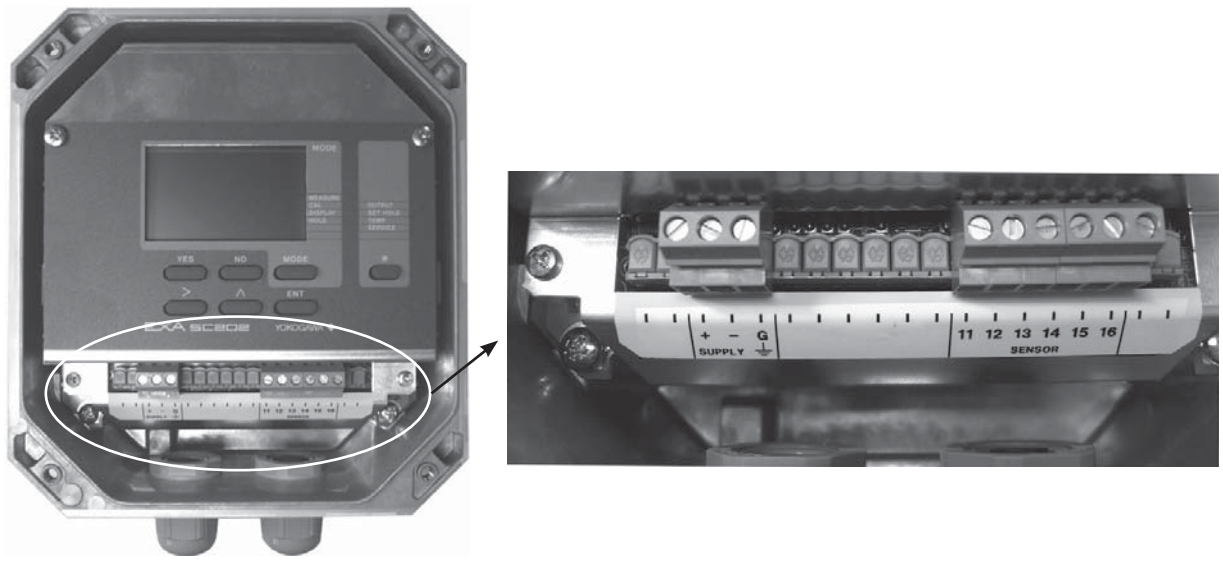



**Figure 3-4. Internal view of EXA wiring compartment**

mA

## 3-2. Preparation

Refer to figure 3-4. The power/output connections and the sensor connections should be made in accordance with the diagram on page 3-6. The terminals are of a plug in style for ease of mounting.

To open the EXA 202 for wiring:

1. Loosen the four frontplate screws and remove the cover.
2. The terminal strip is now visible.
3. Connect the power supply. Use the gland on the left for this cable.
4. Connect the sensor input, using the gland on the right (see fig. 3-5). Switch on the power. Commission the instrument as required or use the default settings.
5. Replace the cover and secure frontplate with the four screws.
6. Connect the grounding terminals to protective earth.
7. The optional hose connection is used to guide the cables coming from an immersion fitting through a protective plastic tubing to the transmitter.

### 3-2-1. Cables, terminals and glands

The SC202 is equipped with terminals suitable for the connection of finished cables in the size range: 0.13 to 2.5 mm (26 to 14 AWG). The glands will form a tight seal on cables with an outside diameter in the range of 6 to 12 mm (0.24 to 0.47 inches).

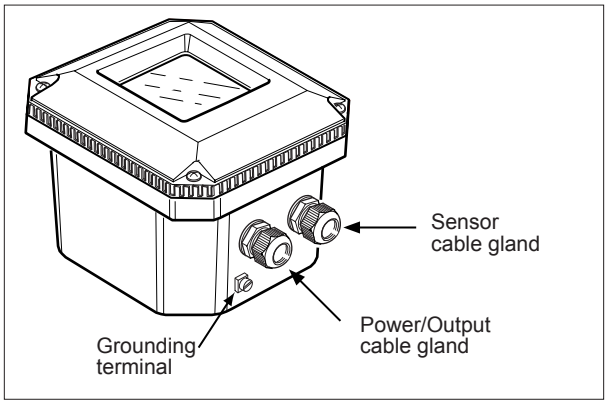



**Figure 3-5. Glands to be used for cabling**

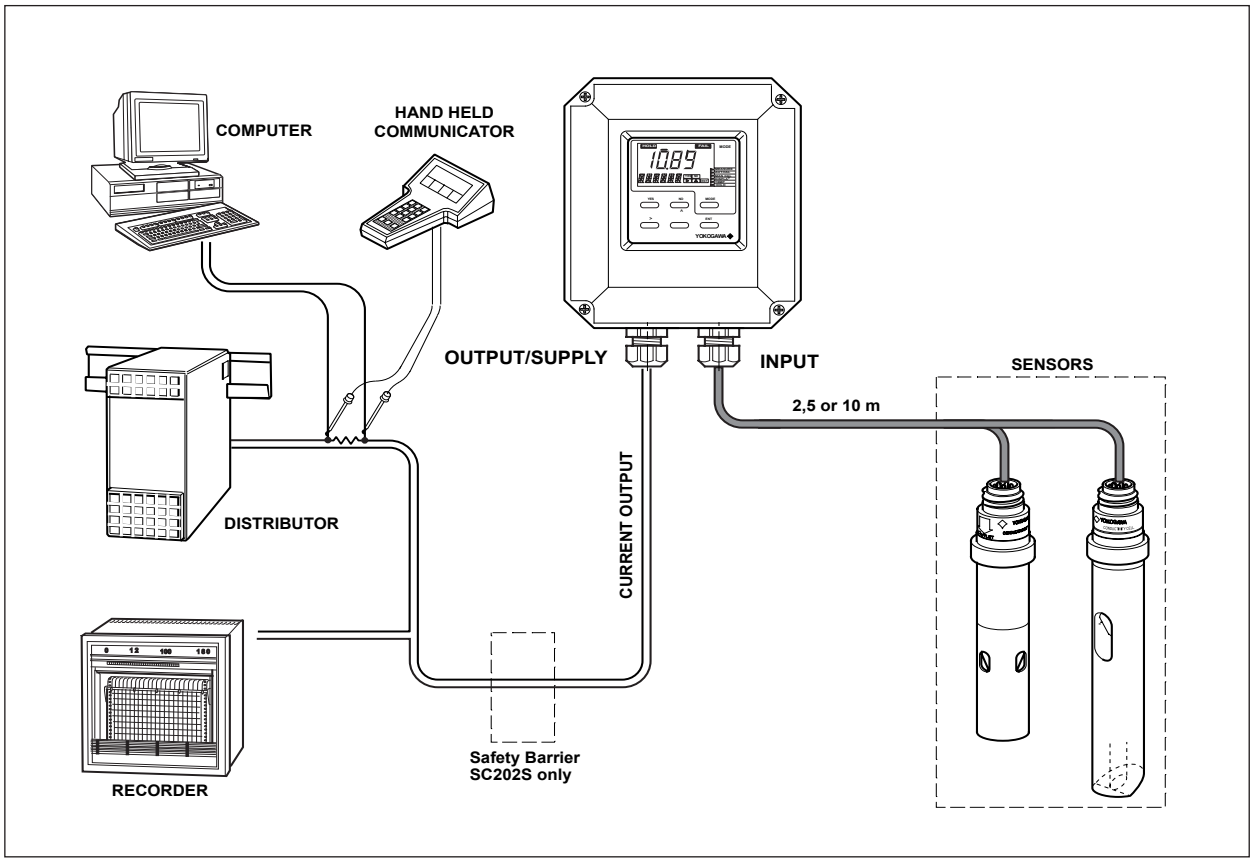



**Figure 3-6. System configuration**

## 3-3. Wiring of sensors

### 3-3-1. General precautions

Generally, transmission of signals from SC sensors is at a low voltage and current level. Thus a lot of care must be taken to avoid interference. Before connecting sensor cables to the transmitter make sure that following conditions are met:

– the sensor cables are not mounted in tracks together with high voltage and or power switching cables
– only standard sensor cables or extension cable are used
– the transmitter is mounted within the distance of the sensor cables (max. 10 m) + up to 50 m WF10 extension cable.
– the setup is kept flexible for easy insertion and retraction of the sensors in the fitting.

### 3-3-2. Additional precautions for installations in hazardous areas - Intrinsic safe

Make sure that the total of capacitance and inductances connected to the input terminals of the EXA SC202S do not exceed the limits given in the certificate.
This sets a limit to the cable and extensions used.

– The intrinsic safe version of the EXA 202 instrument can be mounted in Zone 1.
– The sensors can be installed in Zone 0 or Zone 1 if a safety barrier according to the limits given in the system certificate is used.
– Ensure that the total of capacitance and inductances connected to the terminals of the EXA SC202 do not exceed the limits given in the certificate of the safety barrier or distributor.
– The cable used should preferably have a BLUE colour or marking on the outside.
– Installation for (sensors in Zone 0 or 1):
  Generally, the distributor with input/output isolation has no external earth connection. If there is an earth connection on the distributor and the external connection of the transmitter is connected to “protective” earth, the shield of the 2-wire cable may NOT be connected to “protective” earth at the distributor too.

### 3-3-3. Installation in: Hazardous Area-Non-Incendive

The SC202S-N may be installed in a Category 3/ Zone 2/ Div.2 area without the use of safety barriers. Maximum permissible supply voltage 31.5V.

## 3-4. Wiring of power supply

### 3-4-1. General precautions

⚠ WARNING

Do not activate the power supply yet. First make sure that the DC-power supply is according to the specifications given.

DO NOT USE ALTERNATING CURRENT OR MAINS POWER SUPPLY! !

The cable leading to the distributor (power supply) or safety barrier transports power to and output signal from the transmitter. Use a two conductor shielded cable with a size of at least 1.25 $mm^2$ and an outside diameter of 6 to 12 mm. The cable gland supplied with the instrument accepts these diameters. The maximum length of the cable is 2000 metre, or 1500 metres when using the communications. This ensures the minimum operating voltage for the instrument.

**Grounding:**

- If the transmitter is mounted on a grounded surface (e.g. a metal frame fixed in the soil) the shield of the 2-wire cable may NOT be connected to ground at the distributor.
- If the transmitter is mounted on a non-conducting surface (e.g. a brick wall) it is recommended to ground the shield of the 2-wire cable at the distributor end.

### 3-4-2. Connection of the power supply

The terminal strip is accessed as was described in section 3-2-1. Use the left-hand gland to insert the supply/
output cable to the transmitter. Connect the supply to the terminals marked +, - and G as is indicated in figures 3-11.

**mA** 

### 3-4-3. Switching the instrument on

After all connections are made and checked, the power can be switched on from the distributor. Observe the correct activation of the instrument at the display. If for any reason the display does not indicate a value, consult the trouble shooting section.

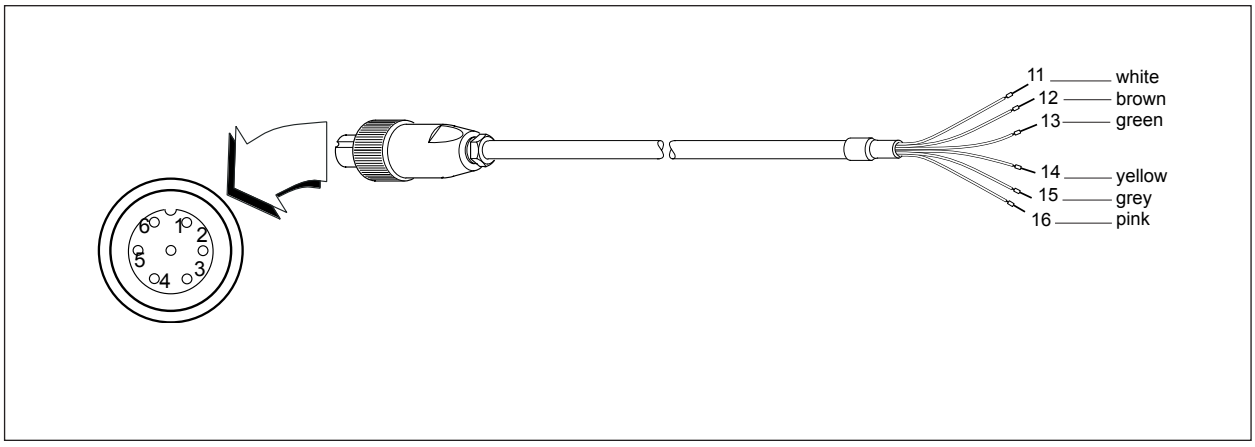



**Fig. 3-7. Connection diagrams**

### 3-5. Sensor wiring

Refer to figure 3-9, which includes drawings that outline sensor wiring.
For the SC4AJ, SC8SG and SC210G sensors, see Appendix 2.

The EXA SC202 can be used with a wide range of commercially available sensor types if provided with shielded cables, both from Yokogawa and other manufacturers. The sensor systems from Yokogawa fall into two categories, the ones that use fixed cables and the ones with separate cables.

To connect sensors with fixed cables, simply match the terminal numbers in the instrument with the identification numbers on the cable ends.

The separate sensors and the WU40-LH□□ cables are also numbered, but the numbers do not always match with the terminal numbers in the instrument. Figure 3-9 indicates how to connect the different sensor types.

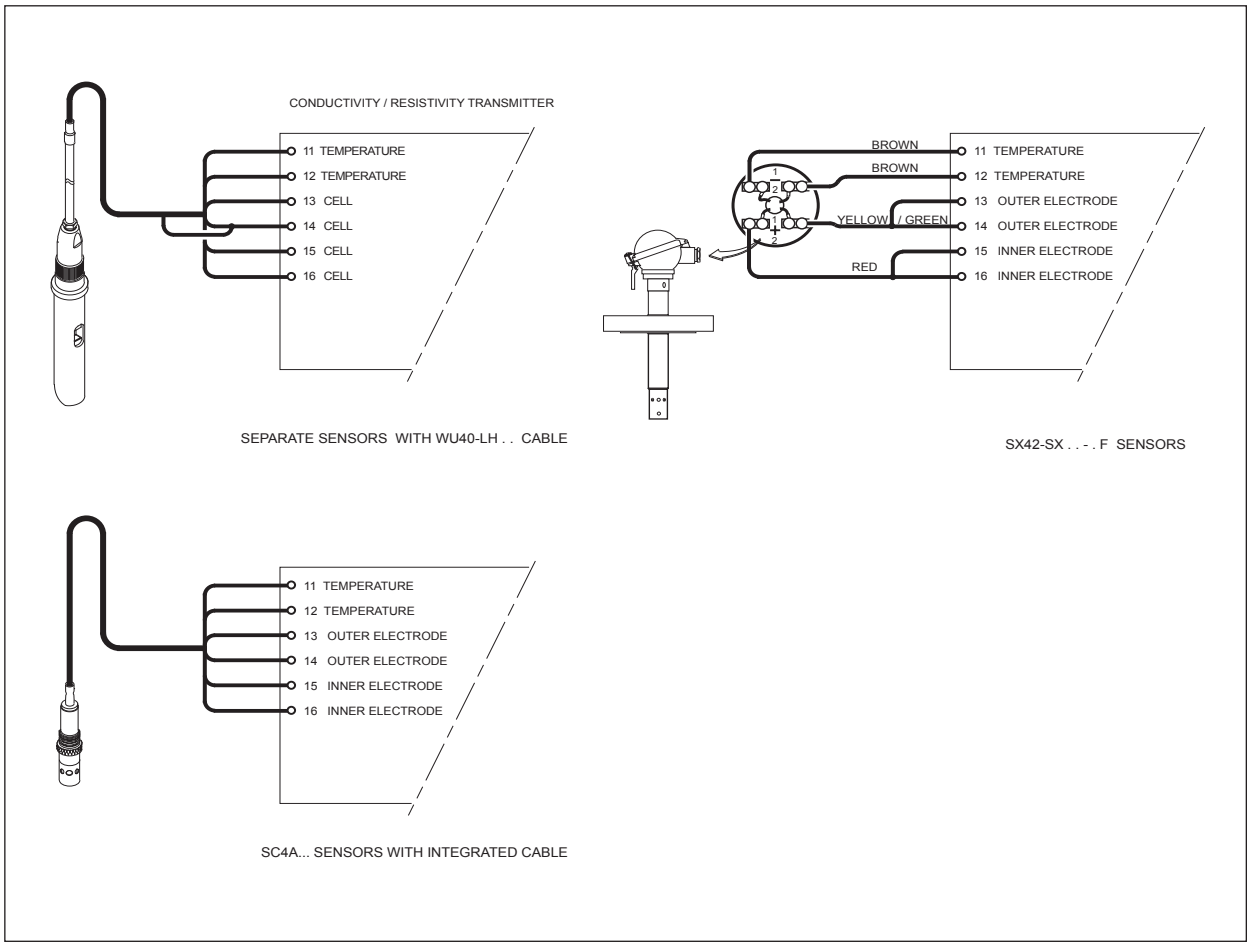



**Figure 3-9. Sensor wiring diagrams**

### 3-6. Other sensor systems

To connect other sensor systems, follow the general pattern of the terminal connections as listed below:
11 and 12 : Always used for temperature compensation resistor input.
13 and 14 : Normally used for the outer electrode
15 and 16 : Used for inner electrode
In case a 4-electrode measuring system will be used, 14 and 16 should be used for the current electrodes.
Please ensure that shielded cabling will be used.
In figure 3-10 this is shown in a schematic way.

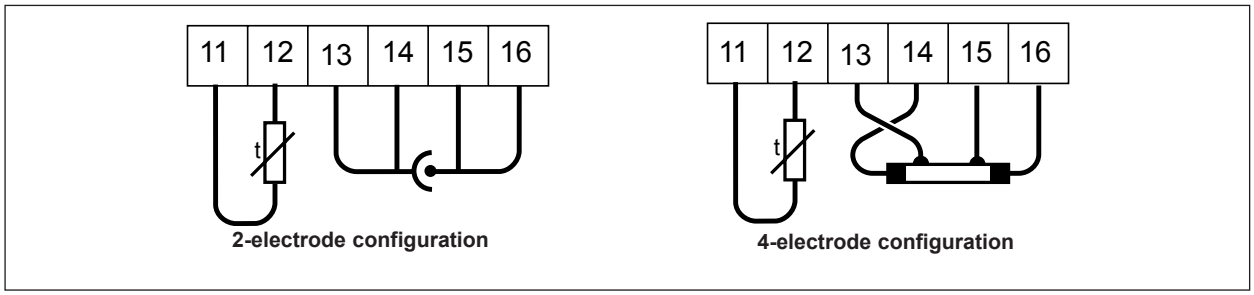



**Figure 3-10. Connection diagram for other sensors**

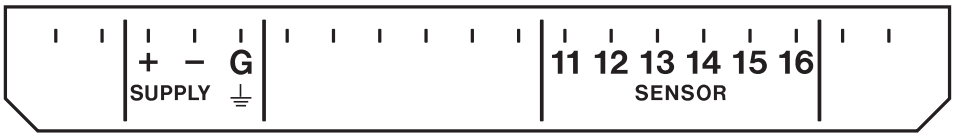



**Figure 3-11. Terminal identification label**

### 3-6-1. Sensor cable connections using junction box (BA10) and extension cable (WF10)

Where a convenient installation is not possible using the standard cables between sensors and transmitter, a junction box and extension cable may be used. The Yokogawa BA10 junction box and the WF10 extension cable should be used. These items are manufactured to a very high standard and are necessary to ensure that the specifications of the system are not compromised. The total cable length should not exceed 60 metres (e.g. 5 m fixed cable and 55 m extension cable).

**Note**: 17 of both WF10 and BA10 do not need to be used.

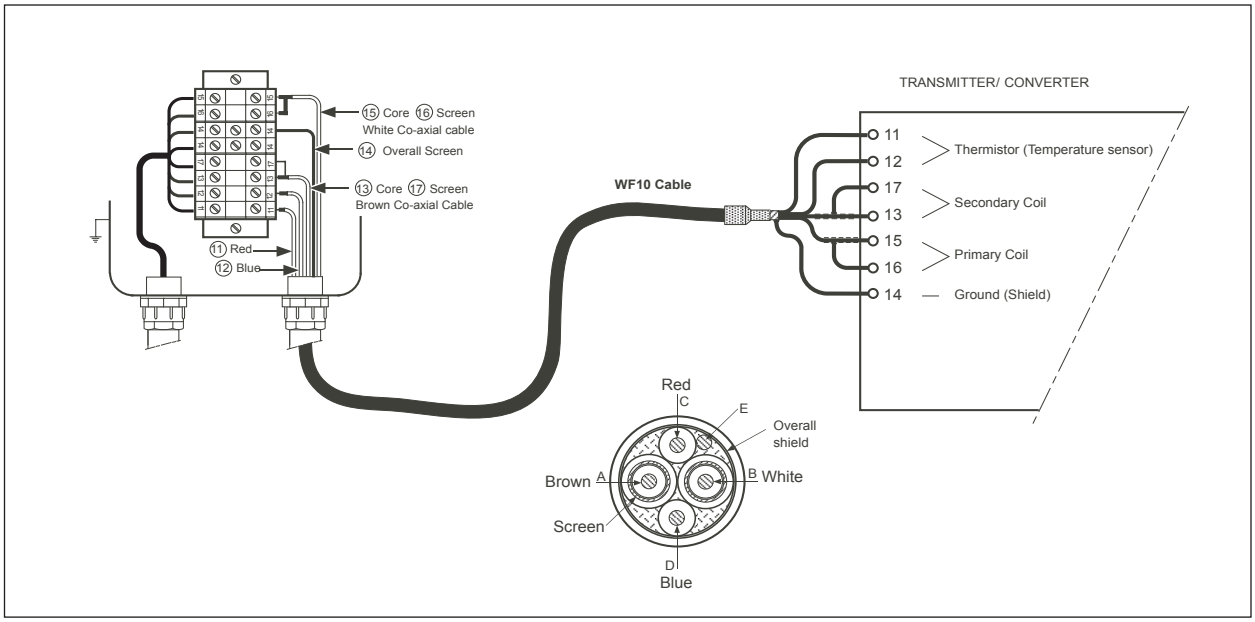
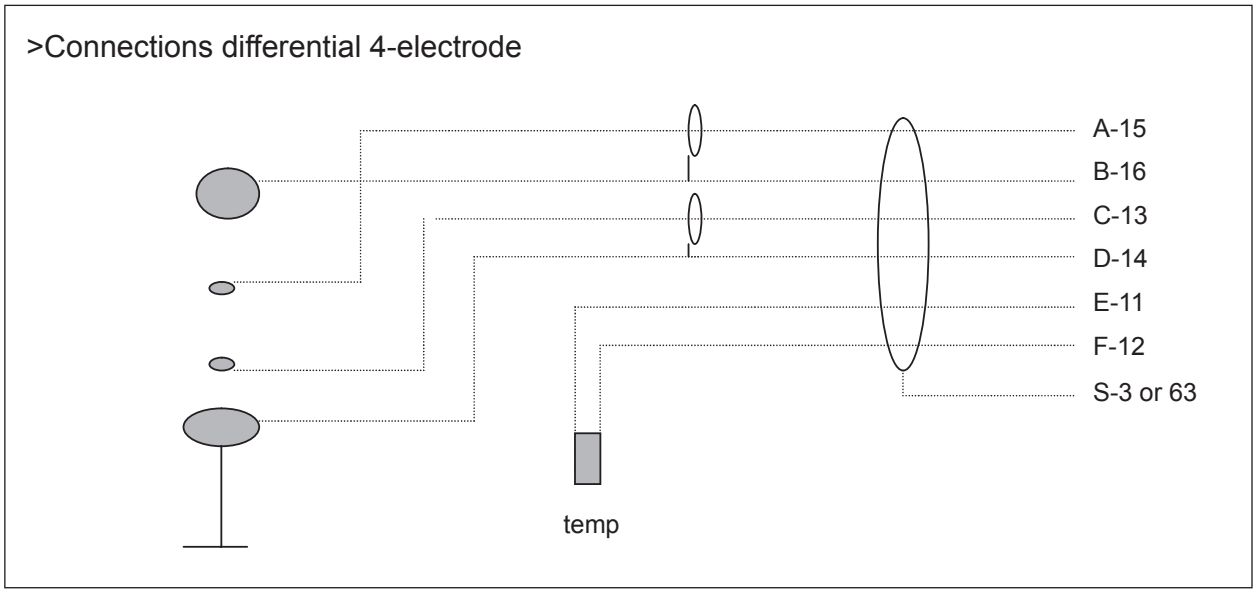



**Fig. 3-12. Connection of WF10 extension cable and BA10/BP10 junction box**

**NOTE**:

See page 3-10 for termination for WF10 cable in combination with EXA SC



Extension cable may be purchased in bulk quantities, cut to length. Then it is necessary to terminate the cable as shown below.

Termination procedure for WF10 cable.
1. Slide 3 cm of heat shrink tube (9 x 1.5) over the cable end to be terminated.
2. Strip 9 cm of the outer (black) insulating material, taking care not to cut or damage internal cores.

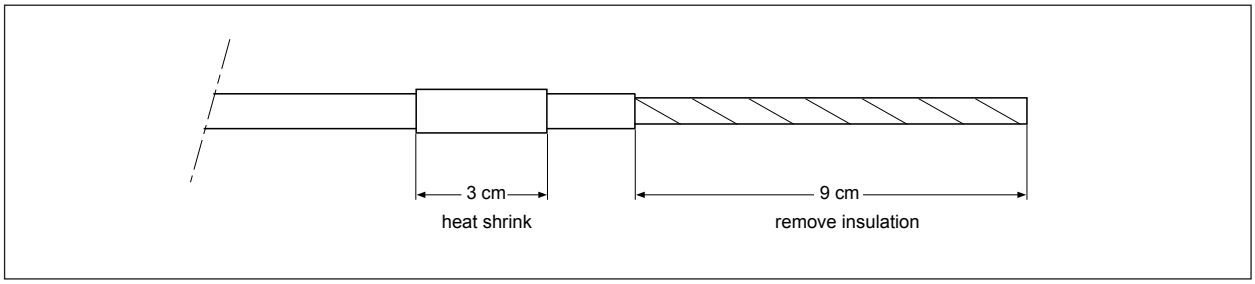



**Fig. 3-13a.**

3. Remove loose copper screening, and cut off the cotton packing threads as short as possible.
4. Strip insulation from the last 3 cm of the brown, and the white coaxial cores.

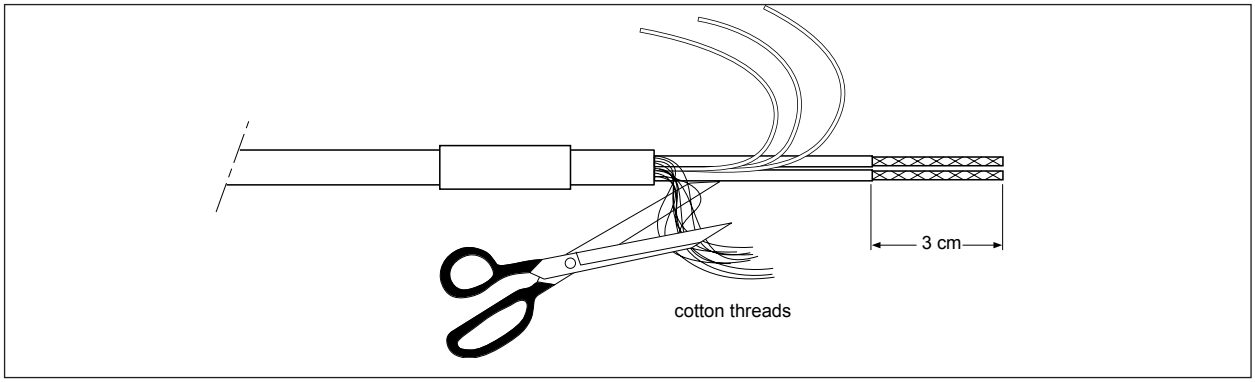



**Fig. 3-13b.**

5. Extract the coaxial cores from the braid, and trim off the black (low-noise) screening material as short as possible.
6. Insulate the overall screen and drain wire (14) and the 2 coaxial screens with suitable plastic tubing.
7. Strip and terminate all ends with suitable (crimp) terminals and identify with numbers as shown.

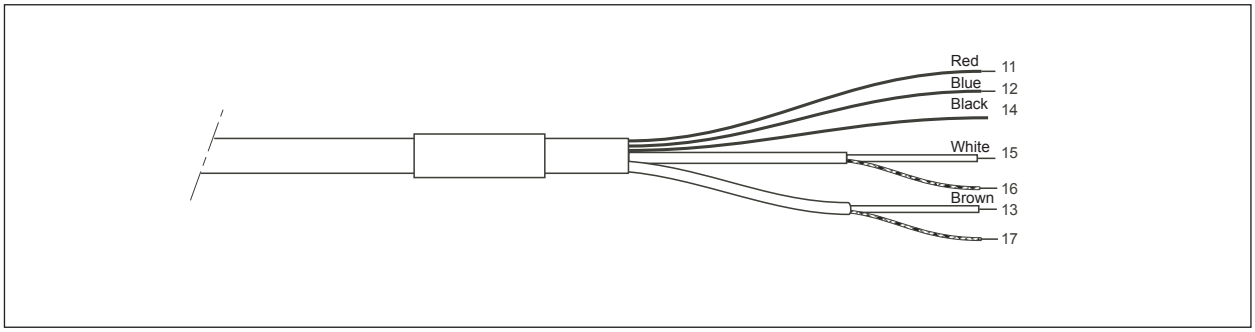



**Fig. 3-13c.**

8. Finally shrink the overall heat shrink tube into position.

## 4. OPERATION; DISPLAY FUNCTIONS AND SETTING

### 4-1. Operator interface

This section provides an overview of the operation of the EXA operator interface. The basic procedures for obtaining access to the three levels of operation are described briefly. For a step-by-step guide to data entry, refer to the relevant section of this user's manual. Figure 4-1 shows the EXA operator interface.

**LEVEL 1: Maintenance**

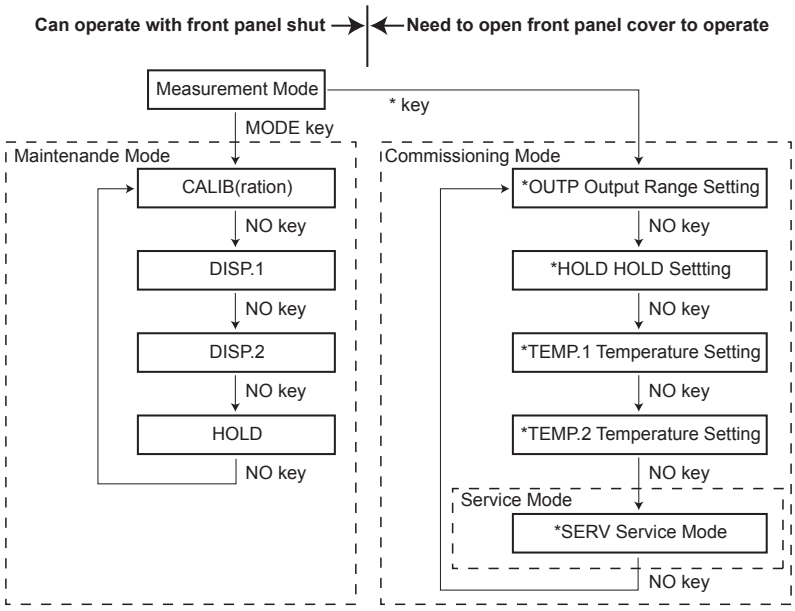
These functions are accessible by pushbutton through a flexible front cover window. The functions make up the normal day-to-day operations that an operator may be required to complete. Adjustment of the display and routine calibration are among the features accessible in this way. (See table 4-1).

**LEVEL 2: Commissioning**

A second menu is exposed when the EXA front cover is removed and the display board is revealed. Users gain access to this menu by pressing the button marked ∗ in the lower right of the display board. This menu is used to set such values as the output ranges and hold features. It also gives access to the service menu. (See table 4-1).

**LEVEL 3: Service**

For more advanced configuration selections, press the button marked ∗ , then press "NO" repeatedly until you reach SERVICE. Now push the "YES" button. Selecting and entering "Service Code" numbers in the commissioning menu provide access to the more advanced functions. An explanation of the Service Codes is listed in chapter 5 and an overview table is shown in chapter 11.




· Select desired mode and press YES
· The MODE key is used as a "Cancel and Return to Measurement Mode" escape key

**Table 4-1. Operations overview**

| | Routine | Function | Chapter |
|---|---|---|---|
| **Maintenance** | CALIB | Calibration with a standard solution or sample | 6 |
| | DISP. 1, 2 | Read auxiliary data or set message display | 4 |
| | HOLD | Switch hold on/off (when activated) | 5 |
| **Commissioning** | *OUTP | Adjust the output range | 5 |
| | *HOLD | Activate the hold function | 5 |
| | *TEMP. 1, 2 | Select method of temperature compensation | 5 |
| **Service** (Access to coded entries from the commissioning level) | *SERV | Fine tune the specialized functions of the transmitter | 5 |

**NOTE**:

All three levels may be separately protected by a password. See Service Code 52 in chapter 5 Service Code table for details on setting passwords.

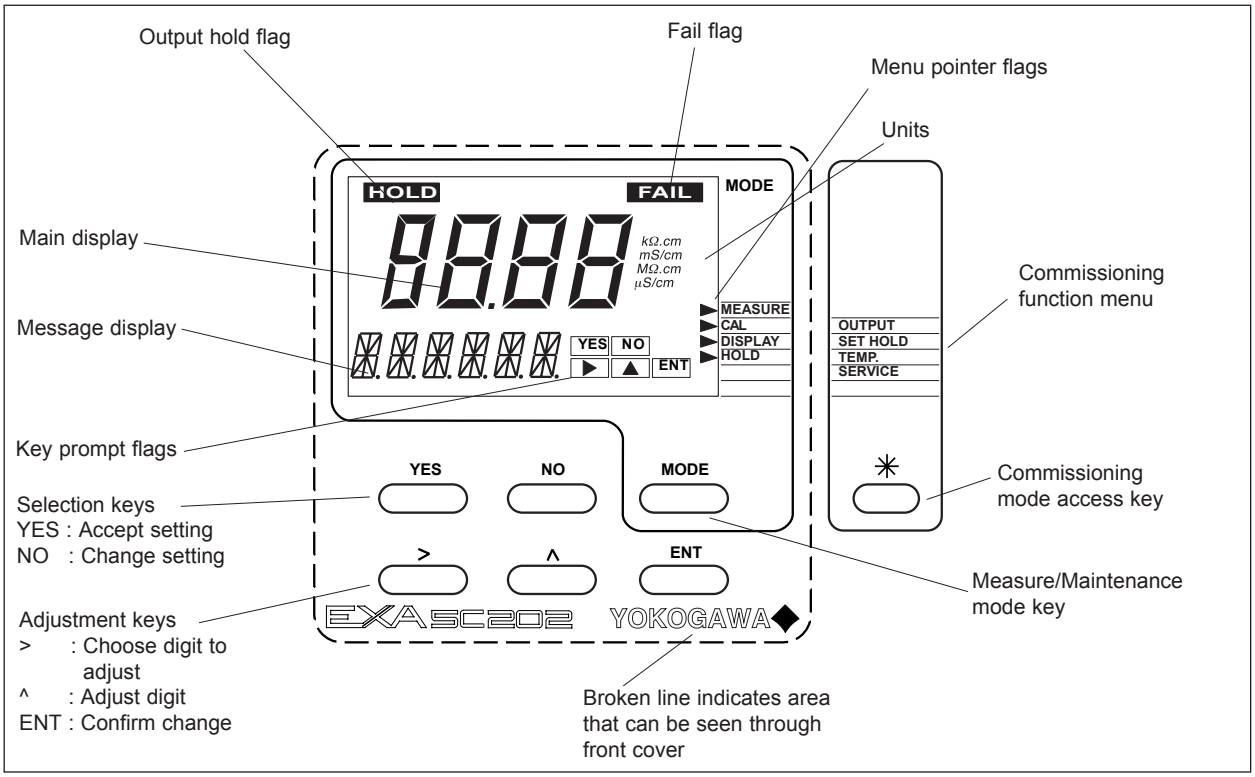



**Figure 4-1. SC202 operator interface**

## 4-2. Explanation of operating keys

**MODE key** This key toggles between the measuring and maintenance modes. Press once to obtain access to the maintenance function menu.

CALIB
DISP.1
DISP.2 - (Only when second temp. compensation enabled)
HOLD - (only when enabled)

Press again to return to the measuring mode (press twice when hold is activated).

**YES/NO keys** These are used to select choices from the menu.
YES is used to accept a menu selection.
NO is used to reject a selection, or to move ahead to the next option.

**DATA ENTRY keys ( ▶ ▲ ENT )**

▶ is used as a "cursor" key. Each press on this key moves the cursor or flashing digit one place to the right. This is used to select the digit to be changed when entering numerical data.

▲ is used to change the value of a selected digit. Each press on this key increases the value by one unit. The value can not be decreased, so in order to obtain a lower value, increase past nine to zero, then increase to the required number.

ENT When the required value has been set using the > and ^ keys, press ENT to confirm the data entry. Please note that the EXA does not register any change of data until the ENT key is pressed.

* key This is the commissioning mode key. It is used to obtain access to the commissioning menu. This can only be done with the cover removed or opened. Once this button has been used to initiate the commissioning menu, follow the prompts and use the other keys as described above.

## 4-3. Setting passcodes

### 4-3-1. Passcode protection

In Service Code 52, EXA users can set passcode protection for each one of the three operating levels, or for any one or two of the three levels. This procedure should be completed after the initial commissioning (setup) of the instrument. The passcodes should then be recorded safely for future reference.

When passcodes have been set, the following additional steps are introduced to the configuration and programming operations:

**Maintenance**
Press MODE key. The display shows 000 and *PASS*
Enter a 3-digit passcode as set in Service Code 52 to obtain access to the Maintenance Mode

**Commissioning**
Press * key. The display shows 000 and *PASS*
Enter a 3-digit passcode as set in Service Code 52 to obtain access to the Commissioning Mode.

**Service**
From the commissioning menu, select *SERV by pressing YES key. The display shows 000 and *PASS*
Enter a 3-digit passcode as set in Service Code 52 to obtain access to the Service Mode.

**NOTE**:
See Service Code 52 for the setting of passcodes.

## 4-4. Display examples

The following pages show the sequence of button presses and screens displayed when working in some standard configurations. More or less options will be made available by the configuration of some service codes, or by choices made in the commissioning menu.

The following deviations are possible:

☆ Item marked is omitted when switched off in commissioning mode.

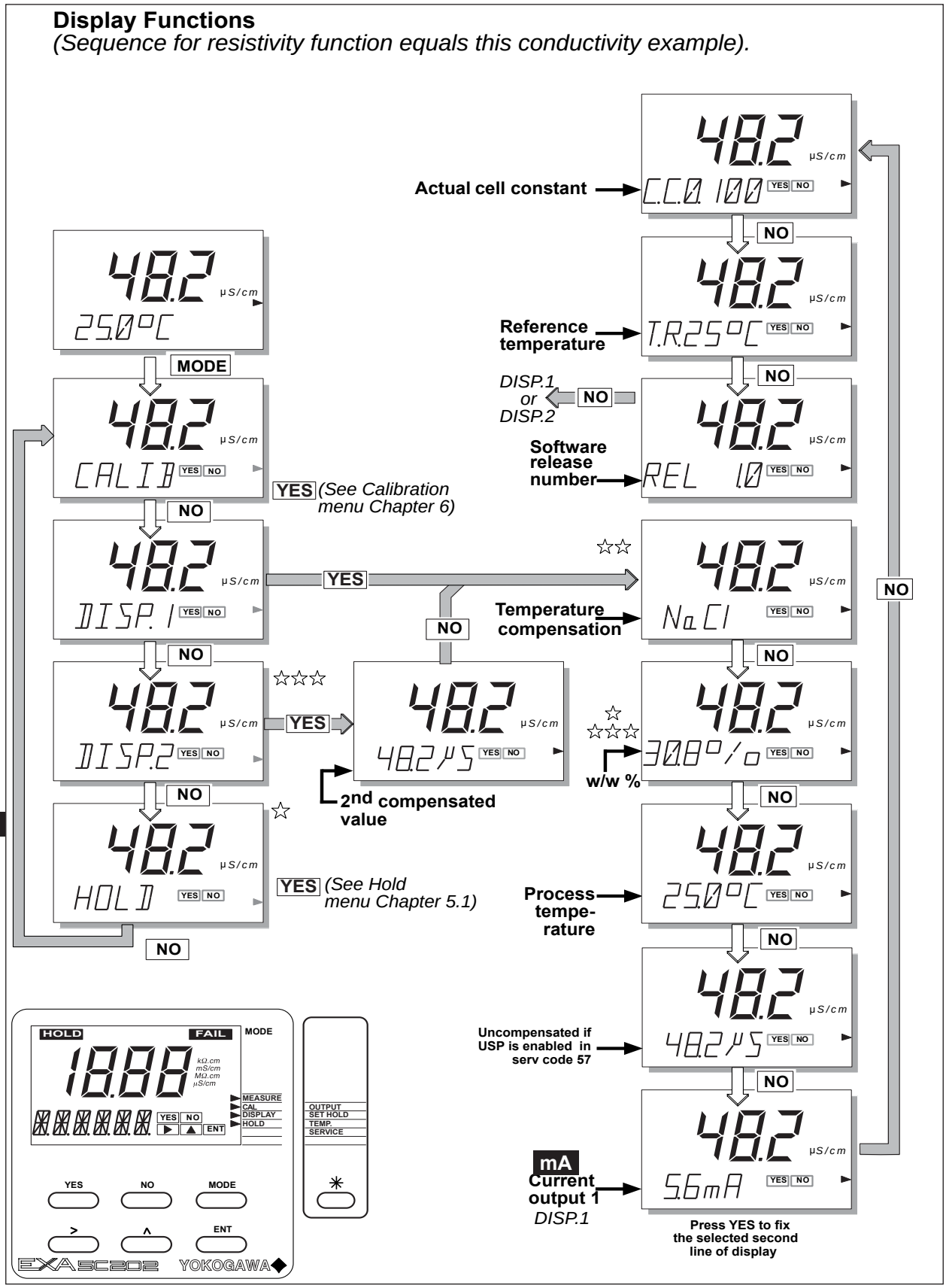
☆☆ Temperature compensation will be displayed dependent on chosen compensation method: NaCl, TC or matrix.

☆☆☆ DISP.2 only appears if a 2nd (different) temperature compensation (*TEMP.2) is set.

☆
☆☆☆ W/W % only appears if switched on in service code 55. In display 2 w/w % never appears.

**4-5. Display functions**

Sequence for resistivity function is similar to this conductivity example.



## 5. PARAMETER SETTING

### 5-1. Maintenance mode

#### 5-1-1. Introduction

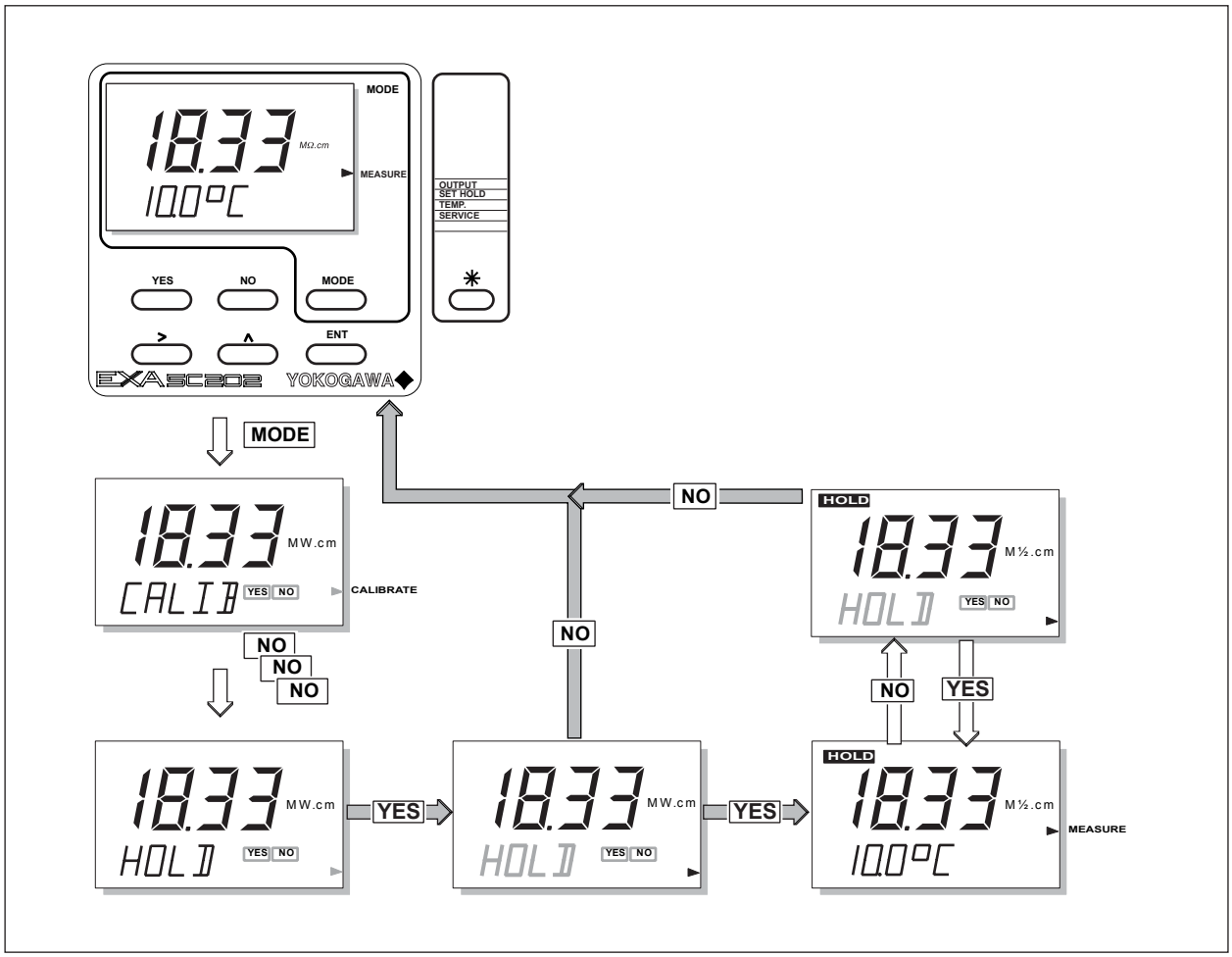
Standard operation of the EXA instrument involves use of the Maintenance (or operating) mode to set up some of the parameters.

Access to the maintenance mode is available via the six keys that can be pressed through the flexible window in the instrument front cover. Press the “MODE” key once to enter this dialog mode.
(Note that at this stage the user will be prompted for a passcode where this has been previously set up in service code 52, section 5)

Calibrate : See “calibration” section 6.
Display setting : See “operation” section 4.
Hold : Manually switch on/off “hold” (when enabled in commissioning menu). See adjustment procedure 5-2-3.

**mA** 

#### 5-1-2. Manual activation of Hold



## 5-2. Commissioning mode

### 5-2-1. Introduction

In order to obtain peak performance from the EXA SC202, you must set it up for each custom application.

*OUTP : mA output is set as default to 0-1 mS/cm or 0-19.99 MΩ·cm.
For enhanced resolution in more stable measuring processes, it may be desirable to select for example 5-10 µS/cm range.

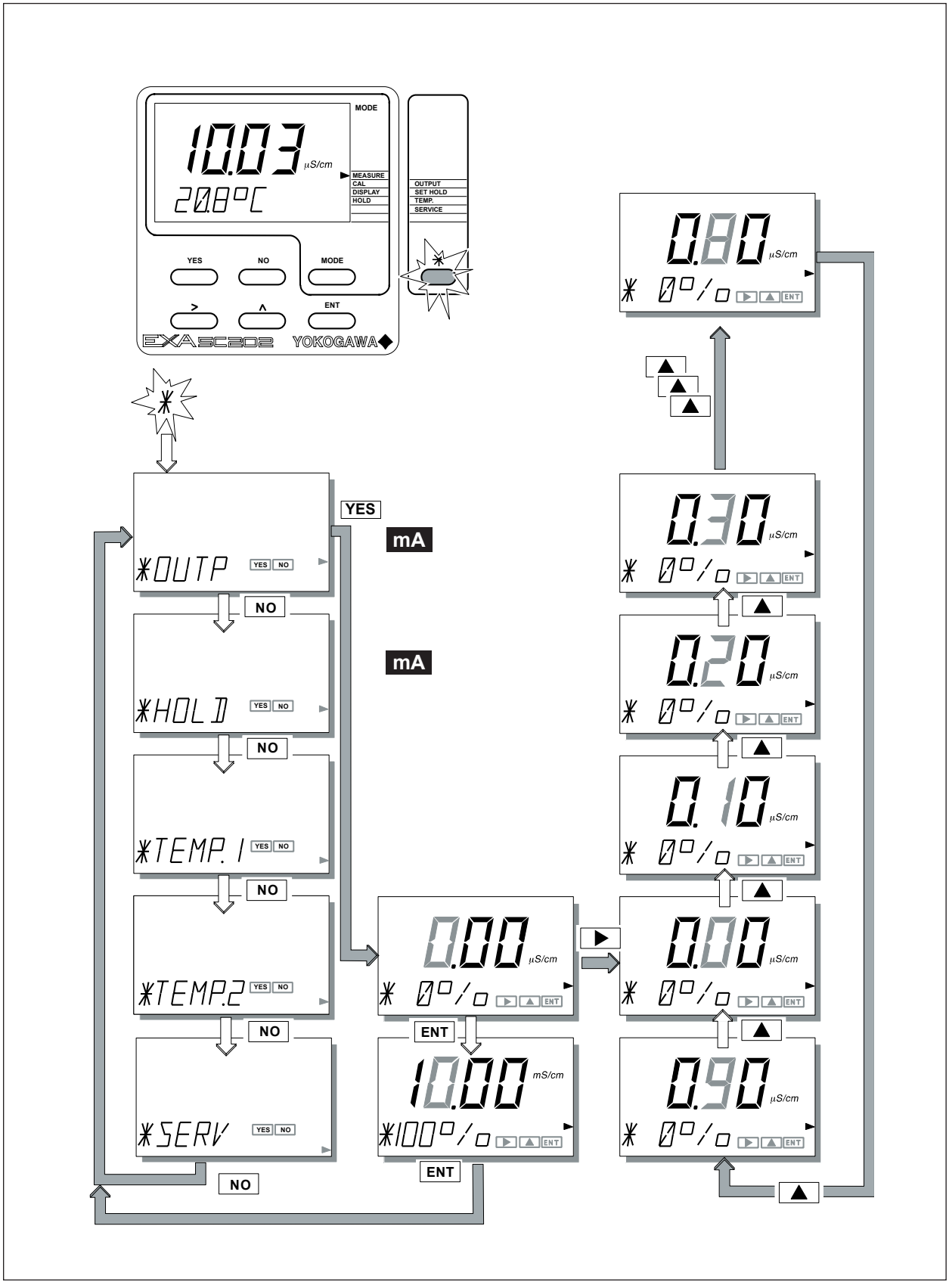
**mA** *HOLD : The EXA SC202 transmitter has the ability to "HOLD" the output during maintenance periods. This parameter should be set up to hold the last measured value, or a fixed value to suit the process.

*TEMP.1, 2 : First and second temperature compensation types and values. (see also section 5-2-4)
* NaCl is the default compensation and is used for neutral salt solutions. Strong solutions of salts are compensated, as are process waters and pure, and ultrapure water.
* TC temperature coefficient compensation uses a linear temperature compensation factor. This can be set by calibration or configuration.
* Matrix compensation is an extremely effective way of compensation. Choose from standard matrix tables, or configure your own to exactly suit your process.

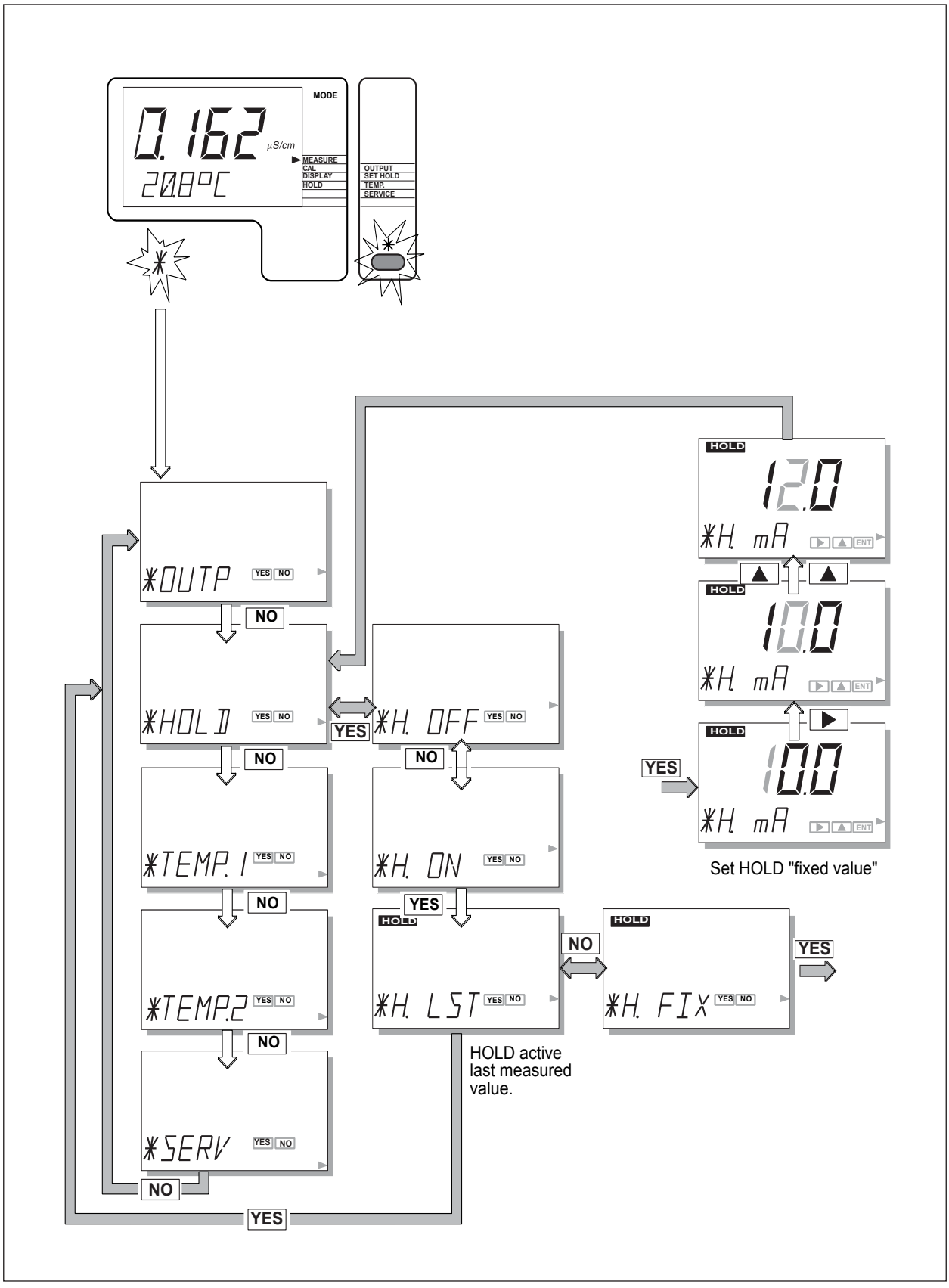
*SERV : This selection provides access to the service menu.

What follows are pictorial descriptions of typical frontplate pushbutton sequences for each parameter setting function. By following the simple YES/NO prompts and arrow keys, users can navigate through the process of setting range, hold and service functions.

### 5-2-2. Range


MODE
10.03 µS/cm
20.8°C
MEASURE
CAL
DISPLAY
HOLD
OUTPUT
SET HOLD
TEMP.
SERVICE
YES
NO
MODE
>
^
ENT
EXA SC202
YOKOGAWA
*OUTP
*HOLD
*TEMP.1
*TEMP.2
*SERV
YES
NO
mA
mA
0.00 µS/cm
*0%
ENT
10.00 mS/cm
*100%
0.10 µS/cm
0.20 µS/cm
0.30 µS/cm
0.80 µS/cm
0.90 µS/cm

## mA 5-2-3. HOLD


MODE
0.162 µS/cm
20.8°C
MEASURE
CAL
DISPLAY
HOLD
OUTPUT
SET HOLD
TEMP.
SERVICE
*OUTP
*HOLD
*TEMP.1
*TEMP.2
*SERV
*H. OFF
*H. ON
*H. LST
*H. FIX
HOLD
12.0
10.0
10.0
*H. mA
YES NO
NO
YES
Set HOLD "fixed value"
HOLD active
last measured
value.

### 5-2-4. Temperature compensation

**1. Why temperature compensation?**

The conductivity of a solution is very dependent on temperature. Typically for every 1 °C change in temperature the solution conductivity will change by approximately 2 %. The effect of temperature varies from one solution to another and is determined by several factors like solution composition, concentration and temperature range. A coefficient (α) is introduced to express the amount of temperature influence in % change in conductivity/°C. In almost all applications this temperature influence must be compensated before the conductivity reading can be interpreted as an accurate measure of concentration or purity.

**Table 5-1. NaCl-compensation according to IEC 60746-3 with Tref = 25 °C**

| T | Kt | α | T | Kt | α | T | Kt | α |
|---|---|---|---|---|---|---|---|---|
| 0 | 0.54 | 1.8 | 60 | 1.76 | 2.2 | 130 | 3.34 | 2.2 |
| 10 | 0.72 | 1.9 | 70 | 1.99 | 2.2 | 140 | 3.56 | 2.2 |
| 20 | 0.90 | 2.0 | 80 | 2.22 | 2.2 | 150 | 3.79 | 2.2 |
| 25 | 1.0 | --- | 90 | 2.45 | 2.2 | 160 | 4.03 | 2.2 |
| 30 | 1.10 | 2.0 | 100 | 2.68 | 2.2 | 170 | 4.23 | 2.2 |
| 40 | 1.31 | 2.0 | 110 | 2.90 | 2.2 | 180 | 4.42 | 2.2 |
| 50 | 1.53 | 2.1 | 120 | 3.12 | 2.2 | 190 | 4.61 | 2.2 |
| | | | | | | 200 | 4.78 | 2.2 |

**2. Standard temperature compensation**

From the factory the EXA is calibrated with a general temperature compensation function based on a sodium chloride salt solution. This is suitable for many applications and is compatible with the compensation functions of typical laboratory or portable instruments.

A temperature compensation factor is derived from the following equation:

$$\alpha = \frac{K_t - K_{ref}}{T - T_{ref}} \times \frac{100}{K_{ref}}$$

In which:

α = Temperature compensation factor (in %/ °C)
T = Measured temperature (°C)
$K_t$ = Conductivity at T
$T_{ref}$ = Reference temperature (°C)
$K_{ref}$ = Conductivity at $T_{ref}$

**3. Manual temperature compensation**

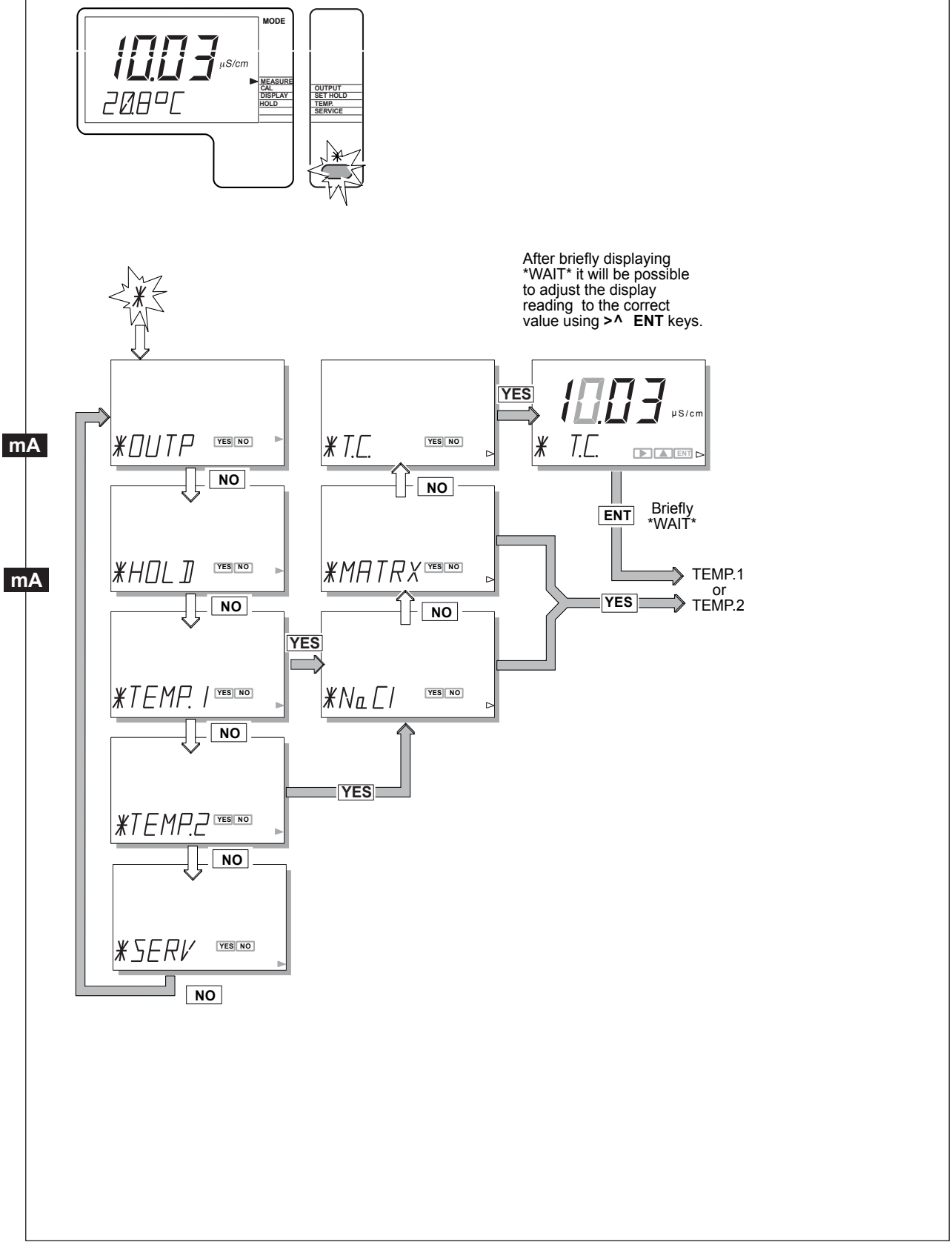
If the standard compensation function is found to be inaccurate for the sample to be measured, the transmitter can be set manually for a linear factor on site to match the application.
The procedure is as follows:

1. Take a representative sample of the process liquid to be measured.
2. Heat or cool this sample to the reference temperature of the transmitter (usually 25 °C).
3. Measure the conductivity of the sample with the EXA and note the value.
4. Bring the sample to the typical process temperature (to be measured with the EXA).
5. Adjust the display indication to the noted value at the reference temperature.
6. Check that the temperature compensation factor has been changed.
7. Insert the conductivity cell into the process again.

**4. Other possibilities (section 5-4)**

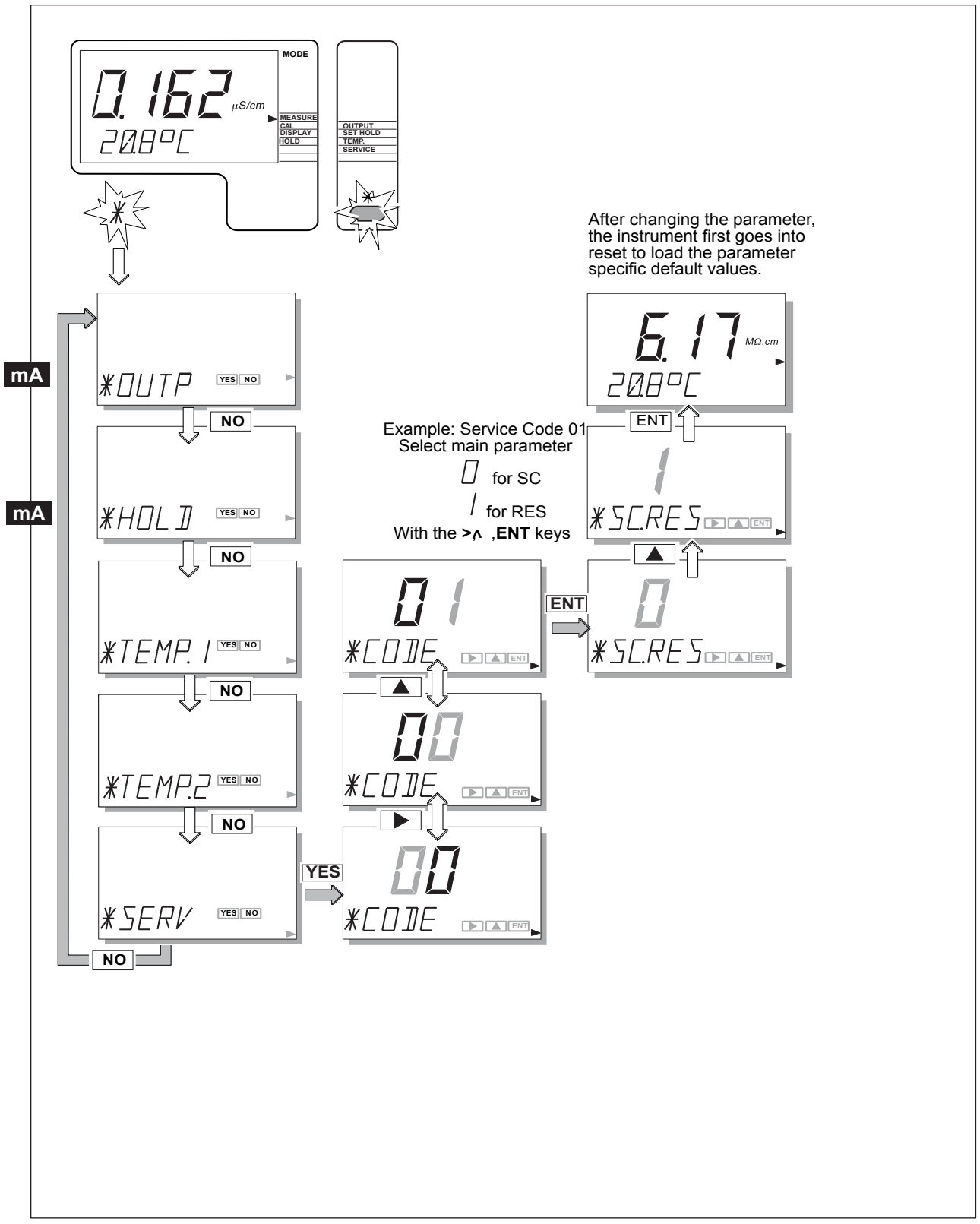
1. Enter calculated coefficient.
2. Enter matrix temperature compensation.

### 5-2-5. Temperature compensation selection



**5-2-6. Service code**

The figure below shows a typical button sequence to change a setting within the service menu. The specific settings are listed in numerical sequence on the following pages. On the page facing the setting tables are concise explanations of the purpose of the service codes.



### 5-3. Service Codes

Don't set or input service code numbers other than the code numbers defined in this manual. Setting an undefined service code may make the transmitter malfunction.
When an undefined service code is input by some accident, push the MODE key and escape from the service level.

#### 5-3-1. Parameter specific functions

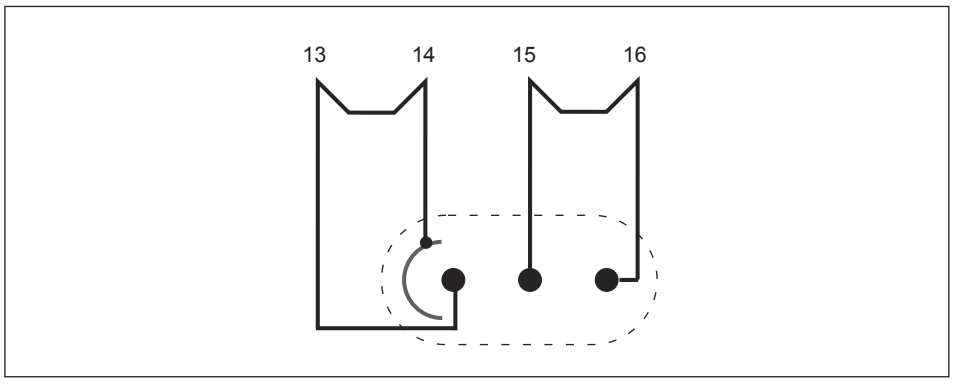
Code 01 *SC.RES Choose the required parameter, either conductivity or resistivity. If the parameter is changed the instrument will go into reset to load parameter specific default values, followed by starting measurement. For all other service codes the instrument will return to commissioning mode after the service code setting is finished.

Code 02 *4.ELEC Choose the required sensor type. Normally conductivity and/or resistivity measurements are done with 2-electrode type sensors. At high conductivity ranges, polarization of the electrodes may cause an error in conductivity measurement. For this reason 4-electrode type sensors may be necessary.

Code 03 *0.10xC Enter the factory calibrated cellconstant mentioned on the textplate or on the fixed cable. This avoids the need for calibration. Any value between 0.008 and 50.0 /cm may be entered. The position of the decimal point may be changed according the visual description in the right-handed page of section 5-2-2.

***NOTE**: If the actual cell constant is changed after a calibration or if the entered cell constant differs from previous value, then the message “*RESET?” will appear on the second line display. After pressing “YES” the entered value becomes the new nominal and calibrated cell constant. After pressing “NO” the update procedure of the cell constant entry is canceled.

Code 04 *AIR To avoid cable influences on the measurement, a “zero” calibration with a dry sensor may be done. If a connection box (BA10) and extension cable (WF10) are be used, “zero” calibration should be done including this connection equipment.
When using a 4-electrode sensor additional connections are required temporarily Interconnect terminals 13 & 14 with each other and 15 & 16 with each other before making the adjustment. This is necessary to eliminate the capacitive influence of the cables. The links should be removed after this step is completed.




Code 05 *POL.CK The EXA SC202 has a polarization check capable of monitoring the signal from the cell for distortion from polarization errors. If there is a problem with the installation or the cell becomes fouled, this will trigger E1. For some application with very low conductivity and long cable runs, this error detection can cause false alarms during operation. Therefore this code offers the possibility to disable/enable this check.

| Code | Display | Function | Function detail | X | Y | Z | Default values | |
|---|---|---|---|---|---|---|---|---|
| **Parameter specific functions** | | | | | | | | |
| 01 | *SC.RES | Select main parameter | Conductivity<br>Resistivity | 0<br>1 | | | 0 | Cond. |
| 02 | *4.ELEC | Select 2/4-EL system | 2-Electrode measurement system<br>4-Electrode measurement system | 0<br>1 | | | 0 | 2-El. |
| 03 | 0.10xC<br><br><br><br><br><br><br><br>RESET? | Set cell constant | Press NO to step through choice of multiplying factors on the second display.<br>0.10xC<br>1.00xC<br>10.0xC<br>100.xC<br>0.01xC<br>Press YES to select a factor<br>Use >, ^, ENT keys to adjust MAIN digits<br>YES to confirm, NO to cancel | | | | 1.000<br>0.10xC | $cm^{-1}$ |
| 04 | *AIR<br>*START<br>*"WAIT"<br>*END | Zero calibration | Zero calibration with dry cell connected<br>Press YES to confirm selection<br>Press YES to start, after briefly displaying "WAIT", *END will be displayed<br>Press YES to return to commissioning mode | | | | | |
| 05 | *POL.CK | Polarization check | Polarization check off<br>Polarization check on | 0<br>1 | | | 1 | On |
| 06-09 | | | Not used | | | | | |

***NOTE**:

For Code 03: If the actual cell constant is changed after a calibration or if the entered cell constant differs from previous value, then the message "RESET?" will appear on the second line display. After pressing "YES" the entered value becomes the new nominal and calibrated cell constant. After pressing "NO" the update procedure of the cell constant entry is canceled.

For Code 04: The temperature compensation of NaCl should be selected to confirm zero offset after *AIR operation.

### 5-3-2. Temperature measuring functions

| | | |
|---|---|---|
| Code 10 | *T.SENS | Selection of the temperature compensation sensor. The default selection is the Pt1000 Ohm sensor, which gives excellent precision with the two wire connections used. The other options give the flexibility to use a very wide range of other conductivity/resistivity sensors. |
| Code 11 | *T.UNIT | Celsius or Fahrenheit temperature scales can be selected to suit user preference. |
| Code 12 | *T.ADJ | With the process temperature sensor at a stable known temperature, the temperature reading is adjusted in the main display to correspond. The calibration is a zero adjustment to allow for the cable resistance, which will obviously vary with length. The normal method is to immerse the sensor in a vessel with water in it, measure the temperature with an accurate thermometer, and adjust the reading for agreement. |

| Code | Display | Function | Function detail | X | Y | Z | Default values | |
|---|---|---|---|---|---|---|---|---|
| **Temperature measuring functions** | | | | | | | | |
| 10 | *T.SENS | Temperature sensor | Pt1000Ω<br>Ni100Ω<br>Pb36 (PB36NTC)<br>Pt100Ω<br>8k55 (8.55kΩNTC) | 0<br>1<br>2<br>3<br>4 | | | 0 | Pt1000 |
| 11 | *T.UNIT | Display in °C or °F | °C<br>°F | 0<br>1 | | | 0 | °C |
| 12 | *T.ADJ | Calibrate temperature | Adjust reading to allow for cable resistance.<br>Use >, ^ , ENT keys to adjust value | | | | | None |
| 13-19 | | | Not used | | | | | |

### 5-4. Temperature compensation functions

Code 20 *T.R.°C Choose a temperature to which the measured conductivity (or resistivity) value must be compensated. Normally 25°C is used, therefore this temperature is chosen as default value. Limitations for this setting are: 0 to 100 °C.
If *T.UNIT in code 11 is set to °F, default value is 77°F and the limitations are 32 - 212°F.

Code 21 *T.C.1, 2 In addition to the procedure described in section 5-2-4 it is possible to adjust the compensation factor directly. If the compensation factor of the sample liquid is known from laboratory experiments or has been previously determined, it can be introduced here.
Adjust the value between 0.00 to 3.50 % per °C. In combination with reference temperature setting in code 20 a linear compensation function is obtained, suitable for all kinds of chemical solutions.

Code 22 *MATRX The EXA is equipped with a matrix type algorithm for accurate temperature compensation in various applications. Select the range as close as possible to the actual temperature/concentration range. The EXA will compensate by interpolation and extrapolation. Consequently, there is no need for a 100% coverage.
If 9 is selected the temperature compensation range for the adjustable matrix must be configured in code 23. Next the specific conductivity values at the different temperatures must be entered in codes 24 to 28.

Code 23 *T1, T2, T3, T4 & T5 °C Set the matrix compensation range. It is not necessary to enter equal temperature steps, but the values should increase from T1 to T5, otherwise the entrance will be refused. Example: 0, 10, 30, 60 and 100 °C are valid values for the T1....T5. The minimum span for the range (T1 - T5) is 25 °C.

Code 24-28 *L1xT1 - L5xT5 In these access codes the specific conductivity values can be entered for 5 different concentrations of the process liquid; each one in one specific access code (24 to 28). The table below shows a matrix entering example for 1 - 15% NaOH solution for a temperature range from 0 - 100 °C.

**NOTES**:
1. In chapter 11 a table is included to record your programmed values. It will make programming easy for duplicate systems or in case of data loss.
2. Each matrix column has to increase in conductivity value.
3. Error code E4 occurs when two standard solutions have identical conductivity values at the same temperature within the temperature range.

**Table 5-2. Example of user adjustable matrix**

| Matrix | | | Example | Example | Example | Example | Example |
|---|---|---|---|---|---|---|---|
| Code 23 | Temperature | T1...T5 | 0 °C | 25 °C | 50 °C | 75 °C | 100 °C |
| Code 24 | Solution 1 (1%) | L1 | 31 mS/cm | 53 mS/cm | 76 mS/cm | 98 mS/cm | 119 mS/cm |
| Code 25 | Solution 2 (3%) | L2 | 86 mS/cm | 145 mS/cm | 207 mS/cm | 264 mS/cm | 318 mS/cm |
| Code 26 | Solution 3 (6%) | L3 | 146 mS/cm | 256 mS/cm | 368 mS/cm | 473 mS/cm | 575 mS/cm |
| Code 27 | Solution 4 (10%) | L4 | 195 mS/cm | 359 mS/cm | 528 mS/cm | 692 mS/cm | 847 mS/cm |
| Code 28 | Solution 5 (15%) | L5 | 215 mS/cm | 412 mS/cm | 647 mS/cm | 897 mS/cm | 1134 mS/cm |

| Code | Display | Function | Function detail | X | Y | Z | Default values | |
|---|---|---|---|---|---|---|---|---|
| **Temperature compensation functions** | | | | | | | | |
| 20 | *T.R.°C | Set reference temp. | Use >, ^, ENT keys to set value | | | | | 25 °C |
| 21 | *T.C.1 | Set temp. coef. 1 | Adjust compensation factor<br>if set to TC in section 5-2-5.<br>Set value with >, ^, ENT keys | | | | | 2.1 %<br>per °C |
| | *T.C.2 | Set temp. coef. 2 | Adjust compensation factor<br>if set to TC in section 5-2-5.<br>Set value with >, ^, ENT keys | | | | | 2.1 %<br>per °C |
| 22 | *MATRX | Select matrix | Choose matrix if set to matrix comp.<br>in section 5-2-5, using >, ^, ENT keys<br>HCl (cation) pure water (0-80 °C)<br>Ammonia pure water (0-80 °C)<br>Morpholine pure water (0-80 °C)<br>HCl (0-5 %, 0-60 °C)<br>NaOH (0-5 %, 0-100 °C)<br>User programmable matrix | <br><br>1<br>2<br>3<br>4<br>5<br>9 | | | 1 | <br><br>HCl |
| 23 | *T1 °C (°F)<br>*T2..<br>*T3..<br>*T4..<br>*T5.. | Set temp. range | Enter 1st (lowest) matrix temp. value<br>Enter 2nd matrix temp. value<br>Enter 3rd matrix temp. value<br>Enter 4th matrix temp. value<br>Enter 5th (highest) matrix temp. value | | | | | |
| 24 | *L1xT1<br>*L1xT2<br>....<br>*L1xT5 | Enter conductivity values for lowest concentration | Value for T1<br>Value for T2<br><br>Value for T5 | | | | | |
| 25 | *L2xT1 | Concentration 2 | Similar to code 24 | | | | | |
| 26 | *L3xT1 | Concentration 3 | Similar to code 24 | | | | | |
| 27 | *L4xT1 | Concentration 4 | Similar to code 24 | | | | | |
| 28 | *L5xT1 | Concentration 5 | Similar to code 24 | | | | | |
| 29 | | | Not used | | | | | |

## mA 5-5. mA output functions

Code 31 *OUTP.F For the SC202 the output may be chosen as linear to input, or configured in a 21 point table to a particular linearization. Enable the table setup in code 31, and configure the table in code 35.

Code 32 *BURN Diagnostic error messages can signal a problem by sending the output signals upscale or downscale (21 mA or 3.6 mA when HART or distributor comm. is non-used, 3.9 mA when HART or distributor comm. is used). This is called upscale or downscale burnout, from the analogy with thermocouple failure signaling of a burned-out or open circuit sensor. The pulse burnout setting gives a 21 mA signal for the first
30 seconds of an alarm condition. After the “pulse” the signal returns to normal. This allows a latching alarm unit to record the error. In the case of the EXA the diagnostics are extensive and cover the whole range of possible sensor faults.

Code 35 *TABLE The table function allows the configuration of an output curve by 21 steps (intervals of 5%). The following example shows how the table may be configured to linearize the output with a mA curve.

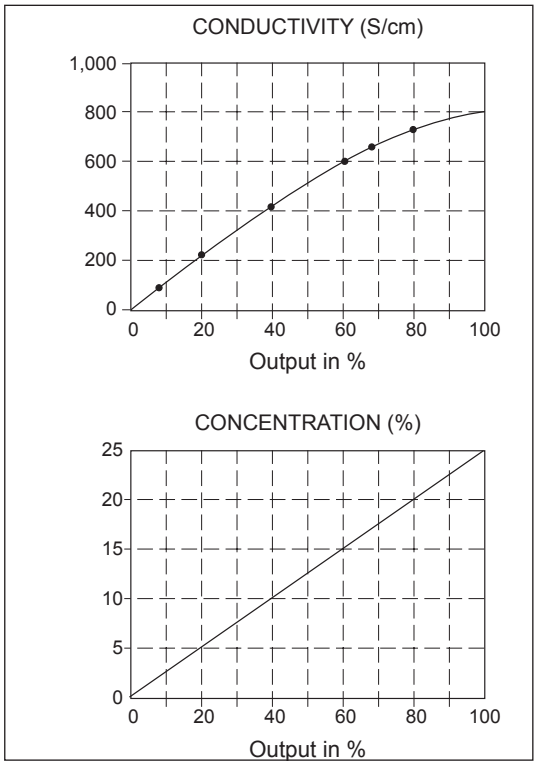



**Fig. 5-1. Linearization of output**
**Example: 0-25% Sulfuric acid**

**Table 5-3.**

| Code Output | 4-20 mA | % $H_2SO_4$ Service code 55 | mS/cm Service code 35 | Default mS/cm |
|---|---|---|---|---|
| 0 | 4.0 | 0.00 | 0 | 0 |
| 5 | 4.8 | 1.25 | 60 | 50 |
| 10 | 5.6 | 2.50 | 113 | 100 |
| 15 | 6.4 | 3.75 | 180 | 150 |
| 20 | 7.2 | 5.00 | 218 | 200 |
| 25 | 8.0 | 6.25 | 290 | 250 |
| 30 | 8.8 | 7.50 | 335 | 300 |
| 35 | 9.6 | 8.75 | 383 | 350 |
| 40 | 10.4 | 10.00 | 424 | 400 |
| 45 | 11.2 | 11.25 | 466 | 450 |
| 50 | 12.0 | 12.50 | 515 | 500 |
| 55 | 12.8 | 13.75 | 555 | 550 |
| 60 | 13.6 | 15.00 | 590 | 600 |
| 65 | 14.4 | 16.25 | 625 | 650 |
| 70 | 15.2 | 17.50 | 655 | 700 |
| 75 | 16.0 | 18.75 | 685 | 750 |
| 80 | 16.8 | 20.00 | 718 | 800 |
| 85 | 17.6 | 21.25 | 735 | 850 |
| 90 | 18.4 | 22.50 | 755 | 900 |
| 95 | 19.2 | 23.75 | 775 | 950 |
| 100 | 20.0 | 25.00 | 791 | 1000 |

**Concentration Output function is done in de following order:**

- Set *OUTP.F. (Service Code 31) to table
- Set the Concentration range in % (Service Code 55)
- Set table values (%output and Conductivity values) in *TABLE (Service Code 35)

**mA**

| Code | Display | Function | Function detail | X | Y | Z | Default values | |
|---|---|---|---|---|---|---|---|---|
| **mA Outputs** | | | | | | | | |
| 30 | | | Not used | | | | | |
| 31 | *OUTP.F | mA output functions | Linear<br>Table | 0<br>1 | | | 0 | Linear |
| 32 | *BURN | Burn function | No burnout<br>Burnout downscale<br>Burnout upscale<br>Pulse burnout | 0<br>1<br>2<br>3 | | | 0 | No Burn. |
| 33, 34 | | | Not used | | | | | |
| 35 | *TABLE<br>*0%<br>*5%<br>*10%<br>...<br>...<br>*95%<br>*100% | Output table for mA | Linearization table for mA in 5% steps. The measured value is set in the main display using the >, ^, ENT keys, for each of the 5% interval steps. Where a value is not known, that value may be skipped, and a linear interpolation will take place. | | | | | |
| 36-39 | | | Not used | | | | | |

**5-6. User interface**

| | | |
|---|---|---|
| Code 50 | *RET. | When Auto return is enabled, the transmitter reverts to the measuring mode from anywhere in the configuration menus, when no button is pressed during the set time interval of 10 minutes. |
| Code 52 | *PASS | Passcodes can be set on any or all of the access levels, to restrict access to the instrument configuration. |
| Code 53 | *Err01 to 13 | Error message configuration. Two different types of failure mode can be set.<br><br>Hard fail gives a steady FAIL flag in the display. A fail signal is transmitted on the mA output when enabled in code 32.<br><br>Soft fail gives a flashing FAIL flag in the display. A good example is the dry sensor for a soft fail. |
| Code 54 | *E5.LIM & *E6.LIM | Limits can be set for shorted and open measurement. Dependent on the main parameter chosen in code 01, the EXA will ask for a resistivity or conductivity value to be set (value to be set is the uncompensated conductivity/resistivity value). |
| Code 55 | *% | For some applications the measured parameter values may be (more or less) linear to concentration. For such applications it is not needed to enter an output table, but 0 and 100% concentration values directly can be set. |
| Code 56 | *DISP. | The display resolution is default set to autoranging for conductivity reading. If a fixed display reading is needed, a choice can be made out of 7 possibilities. For resistivity the default reading is fixed to xx.xx MΩ·cm. |
| Code 57 | *USP. | Automatic checking for compliance with the water purity standard set in USP (United States Pharmacopeia). For more detailed description see chapter 9. |

| Code | Display | Function | Function detail | X | Y | Z | Default values | |
|---|---|---|---|---|---|---|---|---|
| **User interface** | | | | | | | | |
| 50 | *RET. | Auto return | Auto return to measuring mode Off | 0 | | | | |
| | | | Auto return to measuring mode On | 1 | | | 1 | On |
| 51 | | | Not used | | | | | |
| 52 | *PASS | Passcode | Maintenance passcode Off | 0 | | | 0.0.0 | Off |
| | | Note # = 0 - 9, where | Maintenance passcode On | # | | | | |
| | | | Commissioning passcode Off | | 0 | | | Off |
| | | 1=111, 2=333, 3=777 | Commissioning passcode On | | # | | | |
| | | 4=888, 5=123, 6=957 | Service passcode Off | | | 0 | | Off |
| | | 7=331, 8=546, 9=847 | Service passcode On | | | # | | |
| 53 | *Err.01 | Error setting | Polarization too high Soft/Hard | 0/1 | | | 1 | Hard |
| | *Err.05 | | Shorted measurement Soft/Hard | 0/1 | | | 1 | Hard |
| | *Err.06 | | Open measurement Soft/Hard | 0/1 | | | 1 | Hard |
| | *Err.07 | | Temperature sensor open Soft/Hard | 0/1 | | | 1 | Hard |
| | *Err.08 | | Temp. sensor shorted Soft/Hard | 0/1 | | | 1 | Hard |
| | *Err.13 | | USP limit exceeded Soft/Hard | 0/1 | | | 0 | Soft |
| 54 | *E5.LIM | E5 limit setting | Maximum conductivity value | | | | 250 | mS |
| | | | (Minimum resistivity value) | | | | 0.004 | kΩ |
| | *E6.LIM | E6 limit setting | Minimum conductivity value | | | | 1.000 | µS |
| | | | (Maximum resistivity value) | | | | 1.000 | MΩ |
| 55 | *% | Display mA in w/w% | mA-range displayed in w/w% off | 0 | | | 0 | Off |
| | | | mA-range displayed in w/w% on | 1 | | | | |
| | *0% | | Set 0% output value in w/w% | | | | | |
| | *100% | | Set 100% output value in w/w% | | | | | |
| 56 | *DISP. | Display resolution | Auto ranging display | 0 | | | 0 | Auto |
| | | | Display fixed to X.XXX µS/cm or MΩ·cm | 1 | | | | |
| | | | Display fixed to XX.XX µS/cm or MΩ·cm | 2 | | | (2) | |
| | | | Display fixed to XXX.X µS/cm or MΩ·cm | 3 | | | | |
| | | | Display fixed to X.XXX mS/cm or kΩ·cm | 4 | | | | |
| | | | Display fixed to XX.XX mS/cm or kΩ·cm | 5 | | | | |
| | | | Display fixed to XXX.X mS/cm or kΩ·cm | 6 | | | | |
| | | | Display fixed to XXXX mS/cm or kΩ·cm | 7 | | | | |
| 57 | *USP. | USP setting | Disable the E13 (USP limit exceeded) | 0 | | | 0 | Off |
| | | | Enable the E13 (USP limit exceeded) | 1 | | | | |
| 58-59 | | | Not used | | | | | |

### 5-7. Communication setup

| | | | |
|---|---|---|---|
| **mA** | Code 60 | *COMM. | The settings should be adjusted to suit the communicating device connected to the output. The communication can be set to HART® or to PH201*B distributor (see Appendix 2). |
| | | *ADDR. | Select address 00 for point to point communication with 4-20mA transmission. Addresses 01 to 15 are used in multi-drop configuration (fixed 4mA output). |
| **mA** | Code 61 | *HOUR<br>*MINUT<br>*SECND<br>*YEAR<br>*MONTH<br>*DAY | The clock/calendar for the logbook is set for current date and time as reference. |
| | Code 62 | *ERASE | Erase logbook function to clear the recorded data for a fresh start. This may be desirable when re-commissioning an instrument that has been out of service for a while. |

### 5-8. General

| | | |
|---|---|---|
| Code 70 | *LOAD | The load defaults code allows the instrument to be returned to the default set up with a single operation. This can be useful when wanting to change from one application to another. |

### 5-9. Test and setup mode

| | | |
|---|---|---|
| Code 80 | *TEST | Not used. |

**NOTE**: Attempting to change data in service code, 80 and above without the proper instructions and equipment, can result in corruption of the instrument setup, and will impair the performance of the unit.

| | Code | Display | Function | Function detail | X | Y | Z | Default values | |
|---|---|---|---|---|---|---|---|---|---|
| | **Communication** | | | | | | | | |
| mA | 60 | *COMM. | Communication | Set HART® communication Off | 0 | | | 1.0 | On |
| | | | | Set HART® communication On | 1 | | | | |
| | | | | Set communication PH201*B On | 2 | | | | |
| | | | | Communication write enable | | 0 | | | Write |
| | | | | Communication write protect | | 1 | | | enable |
| | | *ADDR. | Network address | Set address 00 to 15 | | | | 00 | |
| mA | 61 | *HOUR<br>*MINUT<br>*SECND<br>*YEAR<br>*MONTH<br>*DAY | Clock setup | Adjust to current date and time using >, ^ and ENT keys | | | | | |
| | 62 | *ERASE | Erase logbook | Press YES to clear logbook data | | | | | |
| | 63-69 | | | Not used | | | | | |

| Code | Display | Function | Function detail | X | Y | Z | Default values | |
|---|---|---|---|---|---|---|---|---|
| **General** | | | | | | | | |
| 70 | *LOAD | Load defaults | Reset configuration to default values | | | | | |
| 71-79 | | | Not used | | | | | |

| Code | Display | Function | Function detail | X | Y | Z | Default values | |
|---|---|---|---|---|---|---|---|---|
| **Test and setup mode** | | | | | | | | |
| 80 | *TEST | Test and setup | Not used. | | | | | |

## 6. CALIBRATION

### 6-1 When is calibration necessary?

Calibration of conductivity/resistivity instruments is normally not required, since Yokogawa delivers a wide range of sensors, which are factory calibrated traceable to NIST standards. The cell constant values are normally indicated on the top of the sensor or on the integral cable. These values can be entered directly in service code 03 (section 5-3-1). If the cell has been subjected to abrasion (erosion or coating) calibration may be necessary. In the next section two examples are given. Alternatively calibration may be carried out with a simulator to check the electronics only.

**NOTE**:

During calibration the temperature compensation is still active. This means that the readings are referred to the reference temperature as chosen in service code 20 (section 5-4, default 25 °C). Calibration is normally carried out by measuring a solution with a known conductivity value at a known temperature. The measured value is adjusted in the calibration mode. On the next pages the handling sequence for this action is visualized. Calibration solutions can be made up in a laboratory. An amount of salt is dissolved in water to give a precise concentration with the temperature stabilized to the adjusted reference temperature of the instrument (default 25 °C). The conductivity of the solution is taken from literature tables or the table on this page.

Alternatively the instrument may be calibrated in an unspecified solution against a standard instrument. Care should be taken to make a measurement at the reference temperature since differences in the type of temperature compensation of the instrument may cause an error.

**NOTE**:

The standard instrument used as a reference must be accurate and based on an identical temperature compensation algorithm. Therefore the Model SC72 Personal Conductivity Meter of Yokogawa is recommended.

Typical calibration solutions.
The table shows some typical conductivity values for sodium-chloride (NaCl) solutions which can be made up in a laboratory.

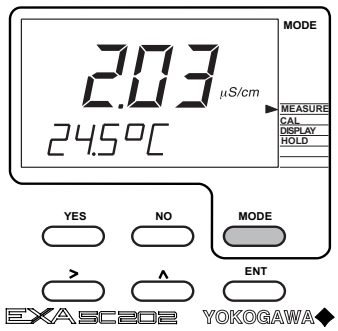
**Table 6-1. NaCl values at 25°C (IEC 60746-3)**

| Weight % | mg/kg | Conductivity |
|---|---|---|
| 0.001 | 10 | 21.4 µS/cm |
| 0.003 | 30 | 64.0 µS/cm |
| 0.005 | 50 | 106 µS/cm |
| 0.01 | 100 | 210 µS/cm |
| 0.03 | 300 | 617 µS/cm |
| 0.05 | 500 | 1.03 mS/cm |
| 0.1 | 1000 | 1.99 mS/cm |
| 0.3 | 3000 | 5.69 mS/cm |
| 0.5 | 5000 | 9.48 mS/cm |
| 1 | 10000 | 17.6 mS/cm |
| 3 | 30000 | 48.6 mS/cm |
| 5 | 50000 | 81.0 mS/cm |
| 10 | 100000 | 140 mS/cm |

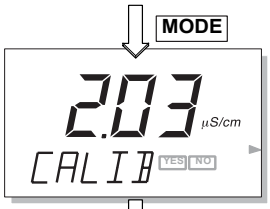
**NOTE**:
For resistivity measurement the standard resistivity units of the calibration solution can be calculated as follows:
$R = 1000/G$ kΩ·cm (if G = µS/cm)

Example:
0.001 weight %
$R = 1000/21.4 = 46.7$ kΩ·cm

## 6-2. Calibration procedure




Press the **MODE** key. The legend CALIB appears, and the **YES/NO** key prompt flags flash.



Put the sensor in standard solution. Press **YES**.

After the indication is stable, set the value using the **>**,**^**, **ENT** key.

Select the flashing digit with the **>** key. Increase its value by pressing the**^** key When the correct value is displayed, press **ENT** to enter the change.

After briefing displaying WAIT, the CAL.END message appears.

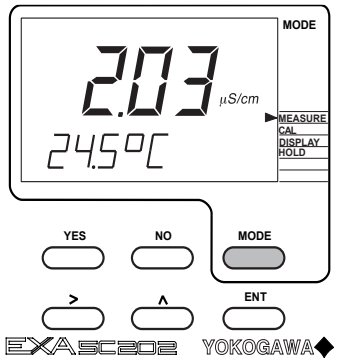
The calibration is now complete. Put the sensor back in the process and press **YES.**

The cell constant is automatically updated after the calibration and the new value can be read on the display as described in section 4.5.

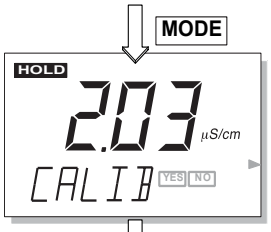
The calculation is as follows: Cell constant in /cm= (Conductivity of calibration solution in mS/cm) x (Cell resistance in kOhm)

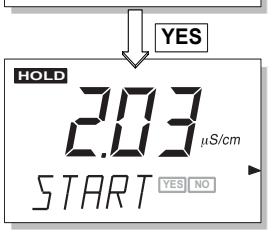
Comparing this calibrated cell constant with the initial nominal cell constant in service code 03 gives a good indication of the stability of the sensor. If the calibrated cell constant differs more than 20% from the nominal cell constant error E3 is displayed.

## 6-3. Calibration with HOLD active




Press the **MODE** key. The legend CALIB appears, and the **YES/NO** key prompt flags flash.




Put the sensor in standard solution. Press **YES**.

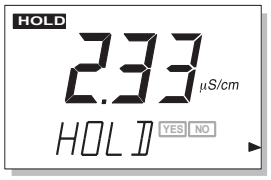
After the indication is stable, set the value using the **>**,**^**, **ENT** key.

Select the flashing digit with the **>** key. Increase its value by pressing the**^** key

When the correct value is displayed, press **ENT** to enter the change.

After briefing displaying WAIT, the CAL.END message appears.

The calibration is now complete. Put the sensor back in the process and press **YES.**




HOLD will be displayed. Press **NO** to turn off HOLD and return to the measuring mode.

## 7. MAINTENANCE

### 7-1. Periodic maintenance for the EXA 202 transmitter

The EXA202 transmitter requires very little periodic maintenance. The housing is sealed to IP65 (NEMA 4X) standards, and remains closed in normal operation. Users are required only to make sure the front window is kept clean in order to permit a clear view of the display and allow proper operation of the pushbuttons. If the window becomes soiled, clean it using a soft damp cloth or soft tissue. To deal with more stubborn stains, a neutral detergent may be used.

**NOTE**:

Never used harsh chemicals or solvents. In the event that the window becomes heavily stained or scratched, refer to the parts list (Chapter 10) for replacement part numbers.

When you must open the front cover and/or glands, make sure that the seals are clean and correctly fitted when the unit is reassembled in order to maintain the housing's weatherproof integrity against water and water vapour. The measurement otherwise may be prone to problems caused by exposure of the circuitry to condensation.

The EXA instrument contains a lithium cell to support the clock function when the power is switched off. This cell needs to be replaced at 5 yearly intervals (or when discharged). Contact your nearest Yokogawa service centre for spare parts and instructions.

### 7-2. Periodic maintenance of the sensor

**NOTE**:

Maintenance advice listed here is intentionally general in nature. Sensor maintenance is highly application specific.

In general conductivity/resistivity measurements do not need much periodic maintenance. If the EXA indicates an error in the measurement or in the calibration, some action may be needed (ref. chapter 8 troubleshooting). In case the sensor has become fouled an insulating layer may be formed on the surface of the electrodes and consequently, an apparent increase in cell constant may occur, giving a measuring error. This error is:

$$2 \times \frac{Rv}{Rcel} \times 100\ \%$$

where:
Rv = the resistance of the fouling layer
Rcel = the cell resistance

**NOTE**:

Resistance due to fouling or to polarization does not effect the accuracy and operation of a 4-electrode conductivity measuring system. If an apparent increase in cell constant occurs cleaning the cell will restore accurate measurement.

**Cleaning methods**

1. For normal applications hot water with domestic washing-up liquid added will be effective.
2. For lime, hydroxides, etc., a 5 ...10% solution of hydrochloric acid is recommended.
3. Organic foulings (oils, fats, etc.) can be easily removed with acetone.
4. For algae, bacteria or moulds, use a solution of domestic bleach (hypochlorite).

* Never use hydrochloric acid and bleaching liquid simultaneously. The very poisonous chlorine gas will result.

## 8. TROUBLESHOOTING

The EXA SC202 is a microprocessor-based analyzer that performs continuous self-diagnostics to verify that it is working correctly. Error messages resulting from faults in the microprocessor systems itself are few. Incorrect programming by the user can be corrected according to the limits set in the following text.

In addition, the EXA SC202 also checks the sensor to establish whether it is still functioning within specified limits.

What follows is a brief outline of some of the EXA SC202 troubleshooting procedures, followed by a detailed table of error codes with possible causes and remedies.

### 8-1. Diagnostics

#### 8-1-1. Off-line checks

The EXA SC202 transmitter incorporates a diagnostic check of the adjusted cell constant value at calibration. If the adjusted value stays within 80 - 120 % of the nominal value set in service code 03, it is accepted. Otherwise, the unit generates an error (E3). With a HART® communication package it is possible to scroll the calibration data in a logbook function.

The EXA also checks the temperature compensation factor while performing manual temperature compensation as described in section 5.2.5. If the TC factor stays within 0.00% to 3.50% per °C, it is accepted. Otherwise, E2 will be displayed.

#### 8-1-2. On-line checks

The EXA performs several on-line checks to optimize the measurement and to indicate a fault due to the fouling or polarization of the connected sensor. The fault will be indicated by the activation of the FAIL flag in the display.

During measurement the EXA adjusts the measuring frequency to give the best conditions for the actual value being measured. At low conductivity there is a risk of error due to the capacitive effects of the cable and the cell. These are reduced by using a low measuring frequency. At high conductivity the capacitive effects become negligible and errors are more likely to be caused by polarization or fouling of the cell. These errors are decreased by increasing the measuring frequency.

At all values the EXA checks the signal from the cell to search for distortion which is typical of capacitive or polarization errors. If the difference between pulse front and pulse rear is > 20% an error E1 will be displayed and the FAIL flag in the display is activated. In service code 05 it is possible to turn this check on and off.

The following error message table gives a list of possible problems that can be indicated by the EXA.

**Table 8-1. Error Codes**

| Code | Error description | Possible cause | Suggested remedy |
|---|---|---|---|
| E1 | Polarization detected on cell | Sensor surface fouled<br>Conductivity too high | Clean sensor and calibrate<br>Replace sensor |
| E2 | Temperature coefficient out of limits (0-3.5%/ºC) | Incorrect field calibration of TC | Re-adjust<br>Set calculated TC |
| E3 | Calibration out of limits | Calibrated value differs more than +/- 20 % of nominal value programmed in code 03. | Check for correct sensor<br>Check for correct unit (µS/cm, mS/cm, kΩ·cm or MΩ·cm)<br>Repeat calibration |
| E4 | Matrix compensation error | Wrong data entered in 5x5 matrix | Re-program |
| E5 | Conductivity too high or resistivity too low (Limits set in service code 54) | Incorrect wiring<br>Internal leakage of sensor<br>Defective cable | Check wiring (3-5)<br>Replace sensor<br>Replace cable |
| E6 | Conductivity too low or resistivity too high (Limits set in service code 54) | Dry sensor<br>Incorrect wiring<br>Defective cable | Immerse sensor<br>Check wiring (3-5)<br>Replace cable |
| E7 | Temperature sensor open<br>(Pt1000 : T > 250°C or 500°F)<br>(Pt100/Ni100 : T > 200°C or 400°F)<br>(8k55 : T < -10°C or 10°F)<br>(PB36 : T < -20°C or 0°F) | Process temperature too high or too low<br>Wrong sensor programmed<br>Incorrect wiring | Check process<br>Check model code sensor<br>Check connections and cable |
| E8 | Temperature sensor shorted<br>(Pt1000/Pt100/Ni100 : T < -20°C or 0°F)<br>(8k55/PB36 : T > 120°C or 250°F) | Process temperature too high or too low<br>Wrong sensor programmed<br>Incorrect wiring | Check process<br>Check model code sensor<br>Check connections and cable |
| E9 | Air set impossible | Too high zero due to cable capacitance | Replace cable |
| E10 | EEPROM write failure | Fault in electronics | Try again, if unsuccessful contact Yokogawa |
| E13 | USP limit exceeded | Poor water quality | Check ion exchangers |
| E15 | Cable resistance influence to temperature exceeds +/- 15°C | Cable resistance too high<br>Corroded contacts<br>Wrong sensor programmed | Check cable<br>Clean and reterminate<br>Reprogram |
| mA E17 | Output span too small | Incorrect configuration by user | Reprogram |
| mA E18 | Table values make no sense | Wrong data programmed | Reprogram |
| E19 | Programmed values outside acceptable limits | Incorrect configuration by user | Reprogram |
| E20 | All programmed data lost | Fault in electronics<br>Very severe interference | Contact Yokogawa |
| E21 | Checksum error | Software problem | Contact Yokogawa |

## 9. USP WATER PURITY MONITORING

### 9-1. What is USP ?

USP stands for United States Pharmacopeia and it is responsible for issuing guidelines for the pharmaceutical industry. Implementing these guidelines is highly recommended for companies wishing to market drugs in the US. This means that USP is important for pharmaceutical companies worldwide. USP recently issued: - USP - recommendations for conductivity measurement. This new USP, aims at the replacement of 5 antiquated laboratory tests by simple conductivity analysis.

### 9-2. What is conductivity measurement according to USP?

Life would be easy, if the limits for the conductivity of injection water were set to be 1.3 µS/cm at a reference temperature of 25°C. However, the committee (PHRMA WQC) who made the USP recommendations, could not agree on a simple Sodium Chloride model for water quality determination. Instead, they chose a Chloride-Ammonia conductivity-pH model in water atmospherically equilibrated ($CO_2$) at 25 °C.

The objective of the WQC was to find an easy way to establish the water quality, so on-line analysis at process temperature was a necessary requirement. However, if it is not possible to choose one temperature response model to work to, then it is also not possible to choose one temperature compensation algorithm.

We as a manufacturer of analytical equipment do not want to go into the details of whether the limiting conductivity values for water quality are based on the Chloride model or the Ammonia model. Our job is to develop on-line analyzers that make it simple for our customers to meet the water quality that is specified as “stage 1: Conductivity Limit as a Function of Temperature.”

If the water exceeds the limits of stage 1, then it can still be acceptable, but requires the customer to proceed to Stage 2, and possibly Stage 3, to validate the water quality. It is our objective to assure that our customers do not exceed the limits in stage 1 to avoid them having to carry out the complicated laboratory checks in Stages 2 and 3.

### 9-3. USP in the SC202

1. In SC202 we have defined an Error Code: E13. This is independent of what range the customer is measuring or what temperature compensation method he is using for water quality monitoring. When the display shows E13, then the water quality exceeds the USP limits, and the FAIL flag on the display is activated to signal that the system needs urgent attention.

2. We have introduced uncompensated conductivity in the DISPLAY menu. In the LCD display the user can read the temperature and the raw conductivity to compare his water quality with the USP table.

3. We have kept all the EXA functionality: It is even possible to have the mA Output and Display readings in resistivity units. Most users will have very good water quality and in the resistivity mode they will have better resolution on the recorder or DCS. The readings are simply the reciprocal values of the conductivity values. In the example mentioned above the contact will close at an uncompensated resistivity of 1/1.76 µS/cm. = 0.568 MΩ·cm.

### 9-4. Setting up SC202 for USP

First enable USP in service code 57. Change the setting from 0 (default) to 1 (enabled).

This activates uncompensated conductivity in the display menu. The E13 feature is also enabled. For E13 the FAIL flag is triggered when the uncompensated conductivity exceeds the relevant value in the graph.

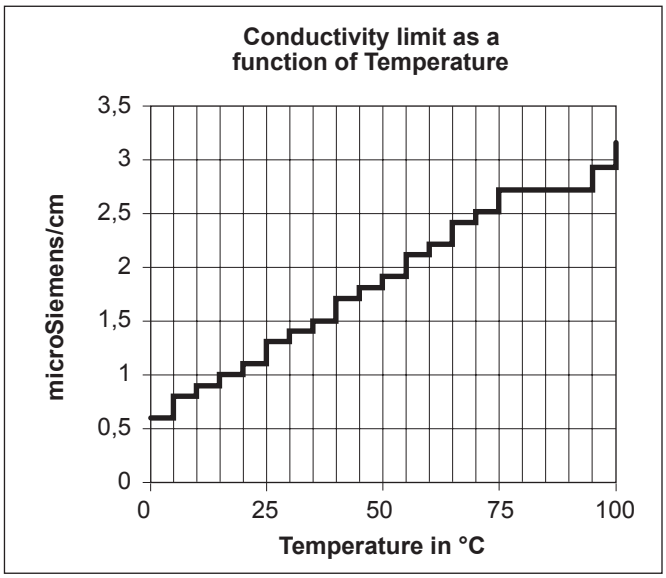



**Fig. 9-1.**

## 10. SPARE PARTS

See Customer Maintenance Parts List.

## 11. APPENDIX 1

### mA 11-1. User setting for non-linear output table (code 31and 35)

| Output signal value | | | | | | | |
|---|---|---|---|---|---|---|---|
| % | mA | | | | | | |
| Output | 4-20 | | | | | | |
| 0 | 4 | | | | | | |
| 5 | 4.8 | | | | | | |
| 10 | 5.6 | | | | | | |
| 15 | 6.4 | | | | | | |
| 20 | 7.2 | | | | | | |
| 25 | 8 | | | | | | |
| 30 | 8.8 | | | | | | |
| 35 | 9.6 | | | | | | |
| 40 | 10.4 | | | | | | |
| 45 | 11.2 | | | | | | |
| 50 | 12 | | | | | | |
| 55 | 12.8 | | | | | | |
| 60 | 13.6 | | | | | | |
| 65 | 14.4 | | | | | | |
| 70 | 15.2 | | | | | | |
| 75 | 16 | | | | | | |
| 80 | 16.8 | | | | | | |
| 85 | 17.6 | | | | | | |
| 90 | 18.4 | | | | | | |
| 95 | 19.2 | | | | | | |
| 100 | 20.0 | | | | | | |

### 11-2. User entered matrix data (code 23 to 28)

| Medium: | | | T1 data | T2 data | T3 data | T4 data | T5 data |
|---|---|---|---|---|---|---|---|
| Code 23 | Temperature | T1...T5 | | | | | |
| Code 24 | Solution 1 | L1 | | | | | |
| Code 25 | Solution 2 | L2 | | | | | |
| Code 26 | Solution 3 | L3 | | | | | |
| Code 27 | Solution 4 | L4 | | | | | |
| Code 28 | Solution 5 | L5 | | | | | |

| Medium: | | | T1 data | T2 data | T3 data | T4 data | T5 data |
|---|---|---|---|---|---|---|---|
| Code 23 | Temperature | T1...T5 | | | | | |
| Code 24 | Solution 1 | L1 | | | | | |
| Code 25 | Solution 2 | L2 | | | | | |
| Code 26 | Solution 3 | L3 | | | | | |
| Code 27 | Solution 4 | L4 | | | | | |
| Code 28 | Solution 5 | L5 | | | | | |

## 11-3. Matrix data table (user selectable in code 22)

| Matrix, Solution | Temp (°C) | Data 1 | Data 2 | Data 3 | Data 4 | Data 5 |
|---|---|---|---|---|---|---|
| **HCL-p (cation)** | | 0 ppb | 4 ppb | 10 ppb | 20 ppb | 100 ppb |
| selection 1 | 0 | 0.0116 µS | 0.0228 µS | 0.0472 µS | 0.0911µS | 0.450 µS |
| | 10 | 0.0230 µS | 0.0352 µS | 0.0631 µS | 0.116 µS | 0.565 µS |
| | 20 | 0.0419 µS | 0.0550 µS | 0.0844 µS | 0.145 µS | 0.677 µS |
| | 30 | 0.0710 µS | 0.085 µS | 0.115 µS | 0.179 µS | 0.787 µS |
| | 40 | 0.1135 µS | 0.129 µS | 0.159 µS | 0.225 µS | 0.897 µS |
| | 50 | 0.173 µS | 0.190 µS | 0.220 µS | 0.286 µS | 1.008 µS |
| | 60 | 0.251 µS | 0.271 µS | 0.302 µS | 0.366 µS | 1.123 µS |
| | 70 | 0.350 µS | 0.375 µS | 0.406 µS | 0.469 µS | 1.244 µS |
| | 80 | 0.471 µS | 0.502 µS | 0.533 µS | 0.595 µS | 1.373 µS |
| **Ammonia-p** | | 0 ppb | 2 ppb | 5 ppb | 10 ppb | 50 ppb |
| selection 2 | 0 | 0.0116 µS | 0.0229 µS | 0.0502 µS | 0.0966µS | 0.423 µS |
| | 10 | 0.0230 µS | 0.0337 µS | 0.0651 µS | 0.122 µS | 0.535 µS |
| | 20 | 0.0419 µS | 0.0512 µS | 0.0842 µS | 0.150 µS | 0.648 µS |
| | 30 | 0.0710 µS | 0.0788 µS | 0.111 µS | 0.181 µS | 0.758 µS |
| | 40 | 0.113 µS | 0.120 µS | 0.149 µS | 0.221 µS | 0.866 µS |
| | 50 | 0.173 µS | 0.178 µS | 0.203 µS | 0.273 µS | 0.974 µS |
| | 60 | 0.251 µS | 0.256 µS | 0.278 µS | 0.344 µS | 1.090 µS |
| | 70 | 0.350 µS | 0.356 µS | 0.377 µS | 0.439 µS | 1.225 µS |
| | 80 | 0.471 µS | 0.479 µS | 0.501 µS | 0.563 µS | 1.393 µS |
| **Morpholine-p** | | 0 ppb | 20 ppb | 50 ppb | 100 ppb | 500 ppb |
| selection 3 | 0 | 0.0116 µS | 0.0272 µS | 0.0565 µS | 0.0963µS | 0.288 µS |
| | 10 | 0.0230 µS | 0.0402 µS | 0.0807 µS | 0.139 µS | 0.431 µS |
| | 20 | 0.0419 µS | 0.0584 µS | 0.108 µS | 0.185 µS | 0.592 µS |
| | 30 | 0.0710 µS | 0.0851 µS | 0.140 µS | 0.235 µS | 0.763 µS |
| | 40 | 0.113 µS | 0.124 µS | 0.181 µS | 0.289 µS | 0.938 µS |
| | 50 | 0.173 µS | 0.181 µS | 0.234 µS | 0.351 µS | 1.12 µS |
| | 60 | 0.251 µS | 0.257 µS | 0.306 µS | 0.427 µS | 1.31 µS |
| | 70 | 0.350 µS | 0.357 µS | 0.403 µS | 0.526 µS | 1.52 µS |
| | 80 | 0.471 µS | 0.481 µS | 0.528 µS | 0.654 µS | 1.77 µS |
| **Hydrochloric Acid** | | 1% | 2% | 3% | 4% | 5% |
| selection 4 | 0 | 65 mS | 125 mS | 179 mS | 229 mS | 273 mS |
| | 15 | 91 mS | 173 mS | 248 mS | 317 mS | 379 mS |
| | 30 | 114 mS | 217 mS | 313 mS | 401 mS | 477 mS |
| | 45 | 135 mS | 260 mS | 370 mS | 474 mS | 565 mS |
| | 60 | 159 mS | 301 mS | 430 mS | 549 mS | 666 mS |
| **Sodium Hydroxide** | | 1% | 2% | 3% | 4% | 5% |
| selection 5 | 0 | 31 mS | 61 mS | 86 mS | 105 mS | 127 mS |
| | 25 | 53 mS | 101 mS | 145 mS | 185 mS | 223 mS |
| | 50 | 76 mS | 141 mS | 207 mS | 268 mS | 319 mS |
| | 75 | 97.5 mS | 182 mS | 264 mS | 339 mS | 408 mS |
| | 100 | 119 mS | 223 mS | 318 mS | 410 mS | 495 mS |

### 11-4. Sensor Selection

#### 11-4-1. General
The inputs of the EXA transmitter are freely programmable for ease of installation. Standard 2-electrode type sensors with a cell constant of 0.100/cm and a Pt1000 temperature sensor, need no special programming. The EXA indicates a fault with a signal in the display field if there is a mismatch of sensors in the connection.

#### 11-4-2. Sensor selection
The EXA SC202 is pre/programmed to accept standard 2-electrode sensors with a Pt1000 temperature sensor. The EXA is universally compatible with all 2- and 4-electrode type of sensors with a cell constant within the range of 0.008/cm to 50.0/cm.

#### 11-4-3. Selecting a temperature sensor
The EXA SC202 reaches its highest accuracy when used with a Pt1000 temperature sensor. This may influence the choice of the conductivity/resistivity sensor, as in most cases the temperature sensor is integrated in the conductivity/resistivity sensor.

### 11-5. Setup for other functions

**mA** • Current Outputs
Transmission signals for the measured parameters can be set up in service codes 30-39.

• Diagnostic checks
Polarization check and checks on the calibrated cell constant and the adjusted Temperature Coefficient, are included in the EXA SC202.

**mA** • Communications
The proprietary HART® communication link allows remote configuration and data retrieval through the PC202 communication package. This is an excellent tool for the maintenance engineer, quality engineer or plant manager. Service codes 60 - 69 are used to set up the communications.

• Logbook
In combination with the communications link, a “logbook” is available to keep an electronic record of events such as error messages, calibrations and programmed data changes. By reference to this log, users can for instance easily determine maintenance or replacement schedules.

**Note:**
On the pages Appendix 1-4 & 1-5 a reference list for the configuration of the SC202 is shown.

## 11-6. User setting table

| FUNCTION | | SETTING DEFAULTS | | USER SETTINGS | |
|---|---|---|---|---|---|
| **Parameter specific functions** | | | | | |
| 01 | *SC.RES | 0 | SC | | |
| 02 | *4.ELEC | 0 | 2-Elec. | | |
| 03 | *0.10xC | 0.10xC | Factor | | |
| | | 1.000 | /cm | | |
| 04 | *AIR | | | | |
| 05 | *POL.CK | 1 | On | | |
| **Temperature measuring functions** | | | | | |
| 10 | *T.SENS | 0 | Pt1000 | | |
| 11 | *T.UNIT | 0 | °C | | |
| 12 | *T.ADJ | | None | | |
| **Temperature compensation functions** | | | | | |
| 20 | *T.R.°C | 25 | °C | | |
| 21 | *T.C.1 | 2.1 | %/°C | | |
| | *T.C.2 | 2.1 | %/°C | | |
| 22 | *MATRX | | None, see 5-2-5 | | |
| 23 | *T1°C | T. range | See sep. table, 11-2 | | |
| 24 | *L1xT1 | Cond. C1 | See sep. table, 11-2 | | |
| 25 | *L2xT1 | Cond. C2 | See sep. table, 11-2 | | |
| 26 | *L3xT1 | Cond. C3 | See sep. table, 11-2 | | |
| 27 | *L4xT1 | Cond. C4 | See sep. table, 11-2 | | |
| 28 | *L5xT1 | Cond. C5 | See sep. table, 11-2 | | |
| **mA outputs** | | | | | |
| 31 | *OUTP.F | 0 | Linear S.C. | | |
| 32 | *BURN | 0 | No Burn | | |
| 35 | *TABLE | 21 pt table | see code 31, 11-1 | | |

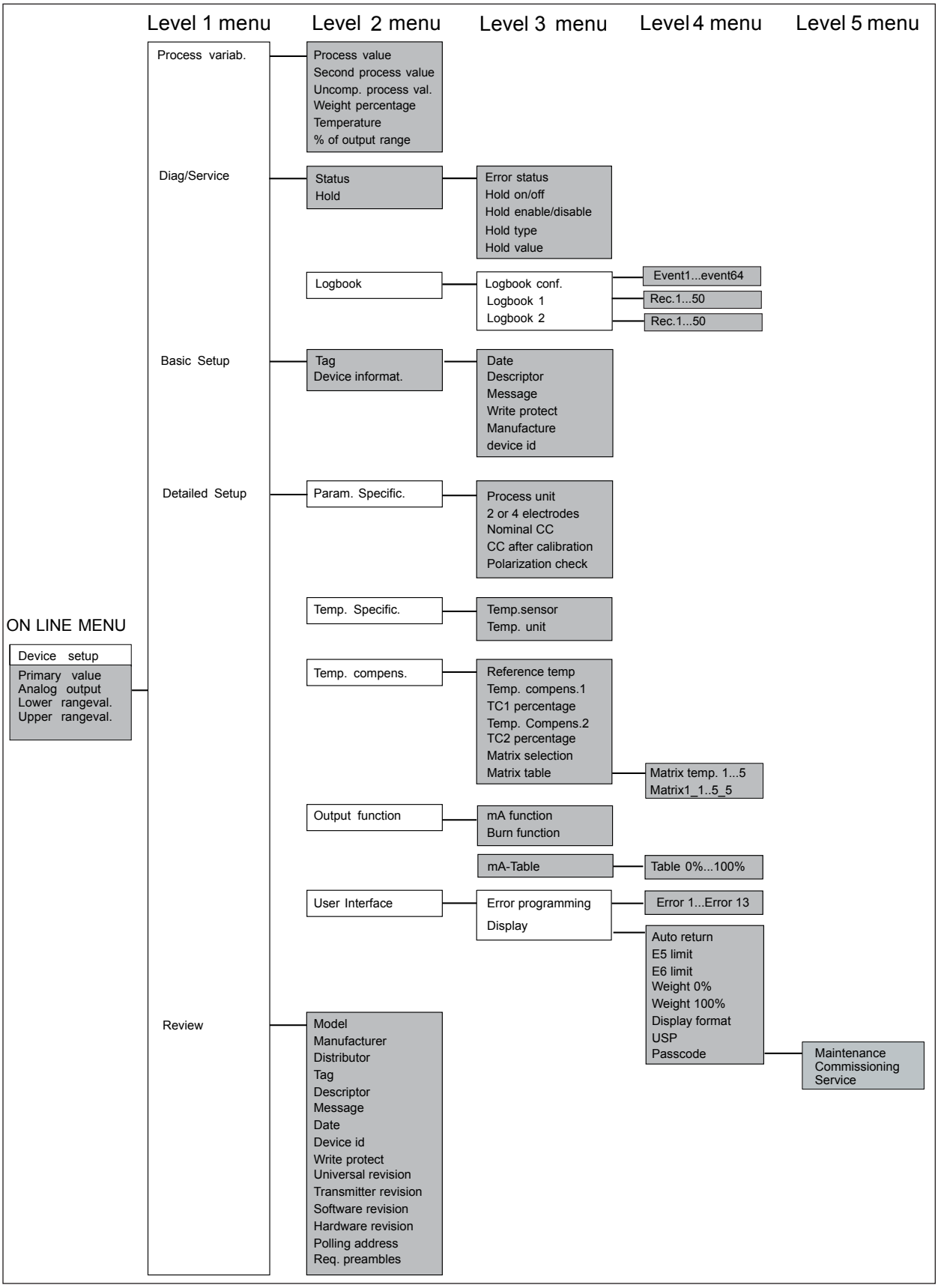
| | FUNCTION | SETTING DEFAULTS | | USER SETTINGS | | |
|---|---|---|---|---|---|---|
| **User Interface** | | | | | | |
| 50 | *RET | 1 | On | | | |
| 52 | *PASS | 0.0.0 | all off | | | |
| 53 | *Err.01 | 1 | hard fail | | | |
| | *Err.05 | 1 | hard fail | | | |
| | *Err.06 | 1 | hard fail | | | |
| | *Err.07 | 1 | hard fail | | | |
| | *Err.08 | 1 | hard fail | | | |
| | *Err.13 | 0 | soft fail | | | |
| 54 | *E5.LIM | 250 | mS | | | |
| | | (0.004) | kΩ | | | |
| | *E6.LIM | 1.000 | µS | | | |
| | | (1.0) | MΩ | | | |
| 55 | *0 % | 0 | Off | | | |
| | 100% | 100.0 | | | | |
| 56 | *DISP | 0 | Auto ranging (SC) | | | |
| | | (2) | (xx.xxMΩ·cm) (RES) | | | |
| 57 | *USP | 0 | Off | | | |
| **Communication** | | | | | | |
| **mA** 60 | *COMM. | 1.0 | On/write ena. | | | |
| | *ADDR. | 00 | 00 | | | |
| **mA** 61 | *HOUR | | | | | |
| 62 | *ERASE | | | | | |
| **General** | | | | | | |
| 70 | *LOAD | | | | | |
| **Test and setup mode** | | | | | | |
| 80 | *TEST | | | | | |

## 11-7. Error codes

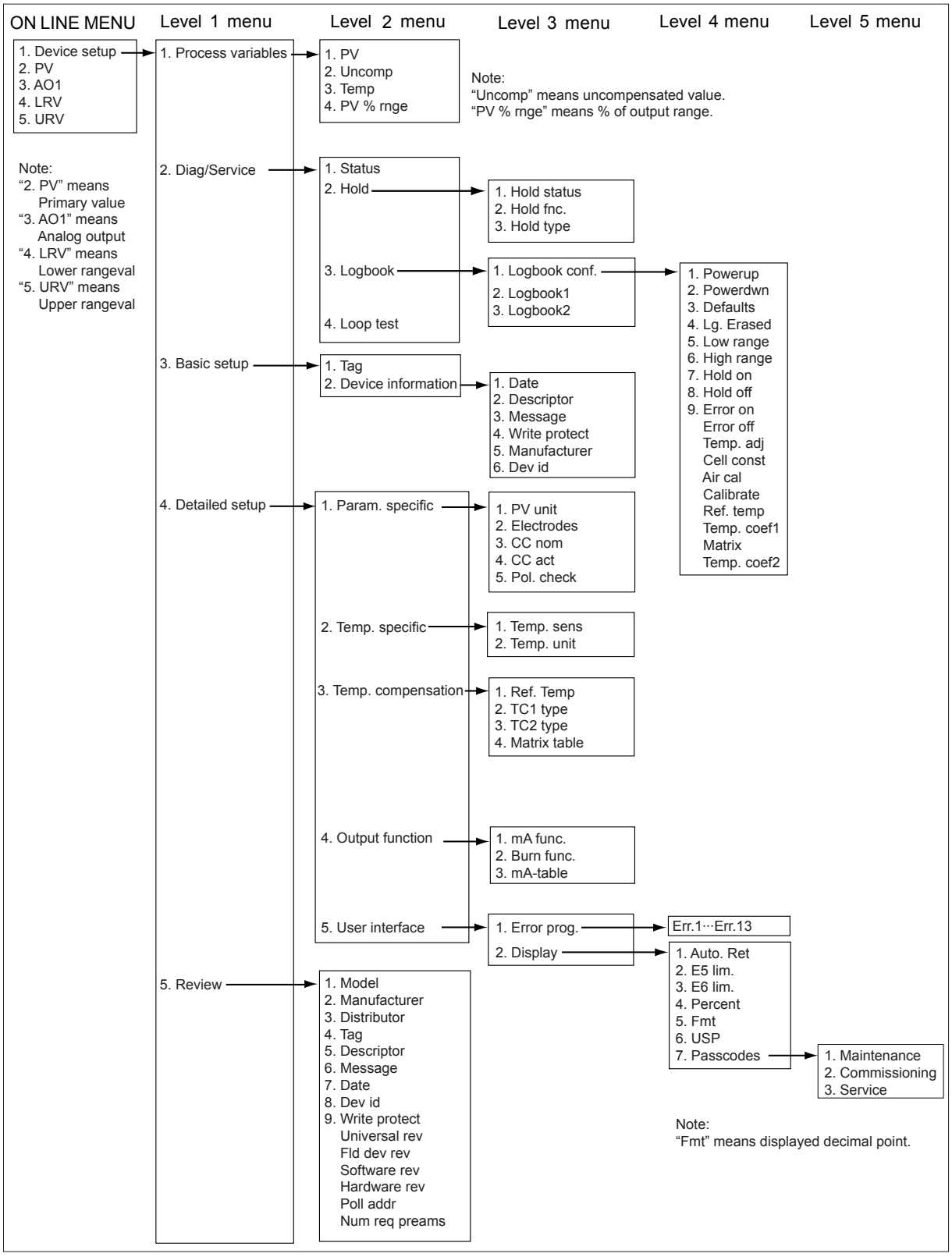
| Code | Error description | Possible cause | Suggested remedy |
|---|---|---|---|
| E1 | Polarization detected on cell | Sensor surface fouled<br>Conductivity too high | Clean sensor<br>Replace sensor |
| E2 | Temperature coefficient out of limits<br>(0-3.5%/ºC) | Incorrect field calibration of TC | Re-adjust<br>Set calculated TC |
| E3 | Calibration out of limits | Calibrated value differs more than<br>+/- 20 % of nominal value programmed<br>in code 03. | Check for correct sensor<br>Check for correct unit (µS/cm,<br>mS/cm, kΩ·cm or MΩ·cm)<br>Repeat calibration |
| E4 | Matrix compensation error | Wrong data entered in 5x5 matrix | Re-program |
| E5 | Conductivity too high or resistivity too low<br>(Limits set in service code 54) | Incorrect wiring<br>Internal leakage of sensor<br>Defective cable | Check wiring (3-6)<br>Replace sensor<br>Replace cable |
| E6 | Conductivity too low or resistivity too high<br>(Limits set in service code 54) | Dry sensor<br>Incorrect wiring<br>Defective cable | Immerse sensor<br>Check wiring (3-6)<br>Replace cable |
| E7 | Temperature sensor open<br>(Pt1000Ω : T > 250°C or 500°F)<br>(Pt100Ω/Ni100Ω : T > 200°C or 400°F)<br>(8k55 : T < -10°C or 10°F)<br>(PB36 : T < -20°C or 0°F) | Process temperature too high or too low<br>Wrong sensor programmed<br>Incorrect wiring | Check process<br>Check model code sensor<br>Check connections and cable |
| E8 | Temperature sensor shorted<br>(Pt1000Ω/Pt100Ω/Ni100Ω : T < -20°C or 0°F)<br>(8k55/PB36 : T > 120°C or 250°F) | Process temperature too high or too low<br>Wrong sensor programmed<br>Incorrect wiring | Check process<br>Check model code sensor<br>Check connections and cable |
| E9 | Air set impossible | Too high zero due to cable capacitance | Replace cable |
| E10 | EEPROM write failure | Fault in electronics | Try again, if unsuccessful con-<br>tact Yokogawa |
| E13 | USP limit exceeded | Poor water quality | Check ion exchangers |
| E15 | Cable resistance influence to temperature<br>exceeds +/- 15°C | Cable resistance too high<br>Corroded contacts<br>Wrong sensor programmed | Check cable<br>Clean and reterminate<br>Reprogram |
| mA E17 | Output span too small | Incorrect configuration by user | Reprogram |
| mA E18 | Table values make no sense | Wrong data programmed | Reprogram |
| E19 | Programmed values outside acceptable limits | Incorrect configuration by user | Reprogram |
| E20 | All programmed data lost | Fault in electronics<br>Very severe interference | Contact Yokogawa |
| E21 | Checksum error | Software problem | Contact Yokogawa |

## mA 11-8. Device Description (DD) menu structure

The Device Description (DD) is available from Yokogawa or the HART foundation. An example is shown below of the ON LINE menu structure. This manual makes no attempt to explain the operation of the Hand Held Terminal (HHT). For detailed operating instructions, refer to the HHT user's manual and the on-line help structure. For menu structure of HHT 375, see next page.



Menu structure for HHT 375 shown below.




**(Note):** HART protocol DD files can be downloaded by following URL.
http://www.yokogawa.com/an/download/an-dl-fieldbus-001en.htm

## 12. APPENDIX 2

### 12-1. Preface

Feasible combinations of the SC202G conductivity transmitters with different styles of the PH201G distributor are listed in the table below. The distributor has the usual distributor functions (supply power to transmitter, receive current output from transmitter, and provide analog output) as well as contact output functions (maintenance, wash and fail status signals). Since the two transmitters provide different digital signals to control the distributor contact outputs, two distributor styles are provided for compatibility. The SC202G is not intrinsically safe (explosionproof), so never install it in a hazardous area.

| Conductivity transmitter SC202G | Use of Distoributor PH201G | | Refference |
|---|---|---|---|
| | No use of contact output | Use of contact output | |
| | Style A & Style B possible | Only Style B possible | Non-Explosionproof type |

T1.eps

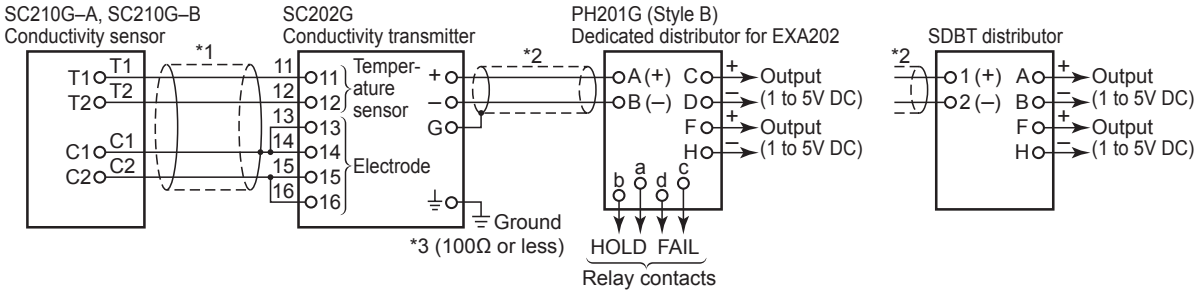
For information about instruments related to the SC202G, SC202S, refer to the following Instruction Manuals.

| Manual Name | IM No. | Instruments mentioned |
|---|---|---|
| Conductivity Sensor | IM 12D08F03-02E | SC4AJ |
| | IM 12D08G02-01E | SC8SG |
| | IM 12D08G03-01E | SC210G |
| PH201G distributor (Style B) | IM 19B01E04-02E | PH201G (Style B) Distributor |
| SDBT disributor | IM 01B04T01-02E | SDBT |
| SDBS disributor | IM 01B04T02-02E | SDBS |
| Attachment rack instrument | IM 1B4F2-01E | Instruments for rack attachment |

## 12-2. Wiring diagrams

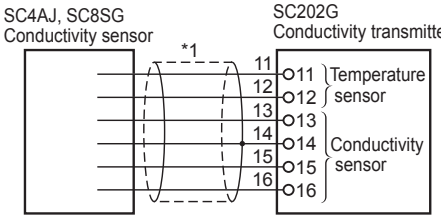
### 1. Example of Non-Explosionproof System

#### (a) SC210G-A or SC210G-B




F08.EPS

#### (b) SC4AJ, SC8SG

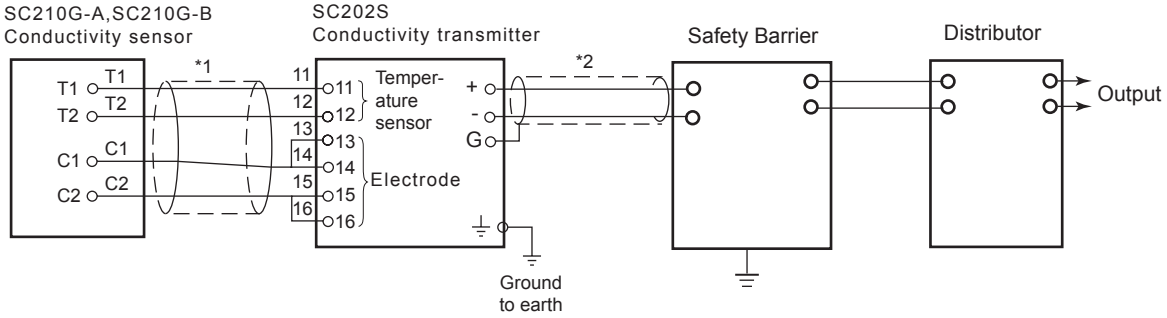



*1 : This cable is specified by the additional code of an conductivity sensor.
*2 : Use a two-conductor shielded cable of OD 6 to 12mm.
The cable length is : Max. 2000m (also the minimum operating voltage of conductivity transmitter must be obtained)
*3 : Conduct grounding without fail on the conductivity transmitter
(Grounding reistance : 100 ½ or less)

F09.EPS

### 2. Example of Intrinsically Safe Explosionproof System

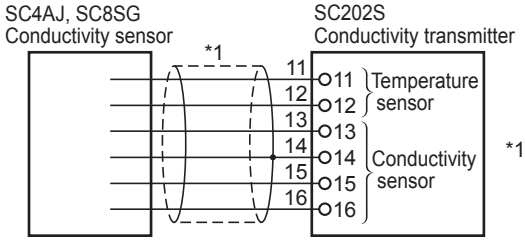
#### (a) SC210G-A or SC210G-B




*1: This cable is specified by the additional code of an conductivity sensor.
*2: Use two-wire cable with OD (Outside Diameter) of 6 to 12 mm.

F007-1.eps

#### (b) SC4AJ, SC8SG




*1 : This cable is specified by the additional code of an conductivity sensor.

F09.EPS

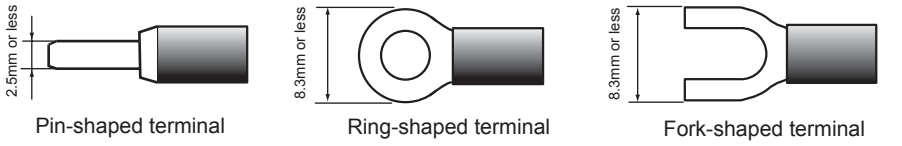
**Cables, terminals and glands**

The SC202 is equipped with terminals suitable for the connection of finished cables in the O.D. range: 6 to 12 mm. The glands will form a tight seal on cables with an outside diameter in the range of 6 to 12 mm. Requirement of connecting with external instruments shown below.

| | Terminal for pin cable terminal | Screw terminal (option /TB) |
|---|---|---|
| Crimp contact for cable | Pin-shaped crimp contact with sleeve insulator | Ring-shaped or fork-shaped crimp contact |
| Usable contact | max. 2.5 mm | Crimp contact shown as the figures under this table, which meets M3 screw |
| Torque for fixing | 0.5 N·m or less | 1.35 N·m (recommended) |
| Example of crimp contact* | Weidmuller Co., Ltd. made: H0.34/10, H0.5/12, H1/12, H1.5/12S | JST, Mfg. Co., Ltd. made: VD1.25-3 (Ring shape), VD1.25-S3A (Fork shape) |

*Note: Other crimp contact may be required , depending on core-cable diameter .

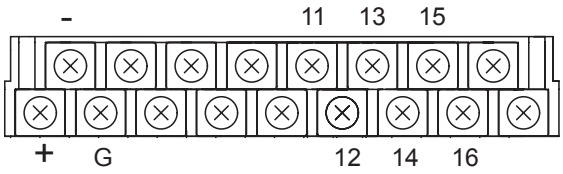
T3.2E.eps




Pin-shaped terminal　Ring-shaped terminal　Fork-shaped terminal

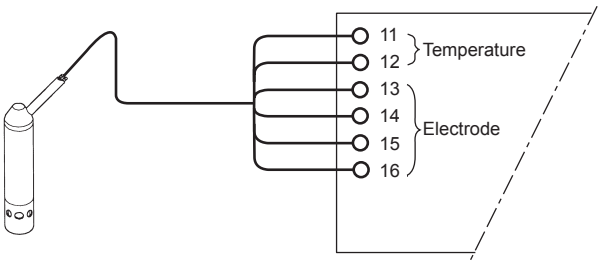
F3.7.EPS

Connection terminal shown below when /TB option specified.

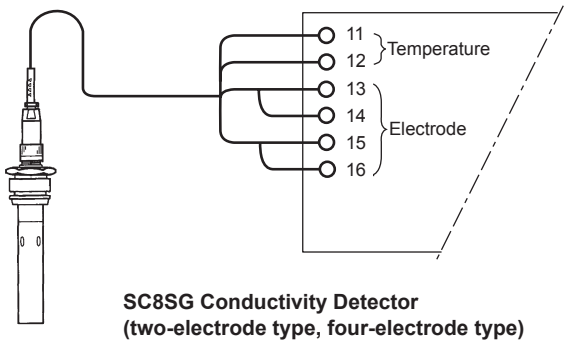


### 12-3. Sensor wiring

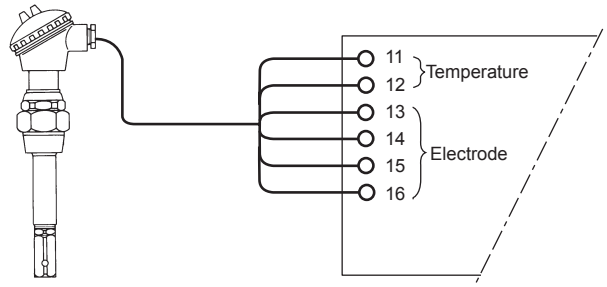
Refer to figure 12-1, which includes drawings that outline sensor wiring. The EXA SC202 can be used with a wide range of commercially available sensor types if provided with shielded cables, both from Yokogawa and other manufacturers. The sensor systems from Yokogawa fall into two categories, the ones that use fixed cables and the ones with separate cables.
To connect sensors with fixed cables, simply match the terminal numbers in the instrument with the identification numbers on the cable ends. For details, refer to corresponding IMs.




**SC4AJ Conductivity Sensor**
**(two-electrode type)**




**SC8SG Conductivity Detector**
**(two-electrode type, four-electrode type)**




**SC210G Conductivity Detector**
**(two-electrode type)**

**Figure 12-1. Sensor wiring diagrams**

## 12-4. Supplement of parameter setting

### 12-4-1. Set cell constant (service code 03)

Code 3 *0.10xC First select a multiplying factor, and then set the constant in consideration of this factor. The position of the decimal point can be selected after the first digit has been set (when the decimal point is flashing).

*How to enter the cell constant

(1) In the case that the only cell constant is mentioned on the text plate of the sensor (SC211G, SC8SG, SC4AJ). How to enter the cell constant of 0.0195 /cm: Select *0.01xC on the message display, and then enter the value of 1.950 on the main display.

(2) In the case that the deviation of a nominal cell constant (± X.X%) is mentioned on the text plate of the sensor (SC210G).
When the nominal cell constant is 5 /cm and the deviation (CORR.% = -1.1) is mentioned:
The cell constant to be entered is calculated as follows:
5 + 5 x (-1.1/100) = 4.945
How to enter the cell constant of 4.945 /cm:
Select *10.0xC on the message display, and then enter the value of 0.495 (rounded to three decimal places) on the main display. (The first digit in the constant setting only accepts 1 or 2.)

### 12-4-2. Temperature sensor (service code 10)

Code 10 *T.SENS Selection of the temperature compensation sensor. The default selection is the PT1000 sensor, which gives excellent precision with the two wire connections used. The other options give the flexibility to use a very wide range of other conductivity/ resistivity sensors. The temperature sensors for the applicable conductivity sensors are as follows. According to the conductivity sensor used, select the appropriate temperature sensor.

* SC210G PB36NTC
* SC211G Pt1000Ω
* SC8SG Pt1000Ω
* SC4AJ Pt1000Ω

| Code | Display | Function | Function detail | X | Y | Z | Default values | |
|---|---|---|---|---|---|---|---|---|
| **Temperature measuring functions** | | | | | | | | |
| 10 | *T.SENS | Temperature sensor | Pt1000Ω | 0 | | | 0 | Pt1000Ω |
| | | | Ni100Ω | 1 | | | | |
| | | | PB36 (PB36NTC) | 2 | | | | |
| | | | Pt100Ω | 3 | | | | |
| | | | 8k55 (8.55kΩNTC) | 4 | | | | |

### 12-4-3. Automatic return (service code 50)

If no key is operated for 10 minutes in any mode other than measurement mode or after 10 minutes in Hold status, Auto-Return (factory setting: On (1) in service code 50) will be activated to return the transmitter to measurement mode. To disable Auto-Return, set the service code 50 to Off (0).

⚠ WARNING

When stopping auto-return function, the transmitter doesn't automatically return to measurement mode. Take care of returning measurement mode for re-measurement.

### 12-4-4. Error setting (service code 53)

Code 53 *Err01 to 13 Error message configuration:
Two different types of failure mode namely, Hard fail and Soft fail can be set. Hard fail gives a steady FAIL flag in the display. When the distributor PH201G (Style B) is used and its communication is enabled in Service Code 60, the fail contact of PH201G (Style B) is closed. A fail signal is transmitted on the mA output when enabled in code 32.
Soft fail gives a flashing FAIL flag in the display. In this case the fail contact of PH201G (Style B) is not closed. A good example is the dry sensor for a soft fail. A warning that the regular maintenance is due, may not be required to shut down the whole measurement.
In addition the hold contact of PH201G (Style B) can be activated as it has nothing to do with the setting of Hard or Soft fail.

### 12-4-5. E5 and E6 setting (service code 54)

Code 54 *E5.LIM & *E6.LIM
Limits can be set for shorted and open measurement. Dependent on the main parameter chosen in code 01, the EXA will ask for a resistivity or conductivity value to be set (value to be set is the uncompensated conductivity/resisitivity value). On the parameter setting screen, you should ignore the unit such as [/cm] and [.cm].
Example: When E5LIM is 250 mS [/cm] and the detector has a cell constant of 10 $cm^{-1}$ then 250 mS x 10 $cm^{-1}$= 2500 mS/cm.

### 12-4-6. Communication with PH201G (style B) distributor (service code 60)

This communication is a one-way to PH201G (Style B) distributor, a power supplier for the EXA 202 transmitters.
The PH201G (Style B) receives a current signal (4-20 mA DC) and a digital signal superimposed on the DC signal.
In other words, the PH201G (Style B) provides a measurement signal, a hold-contact signal and a fail-contact signal.
The communication with PH201G (Style B) is set in Service code 60.

Code 60 *COM When used with our PH201G (Style B) you can enable or disable contact outputs, namely, Fail contact and Hold contact. The PH201G (Style B) can output Hold contact and Fail contact signals. You can set Service Code 53 to "0" for "soft fail" to disable Fail contact output. When you set Service Code 53 to "1" for "hard fail", set Service Code 60 to "2.0" to enable Fail contact output of PH201G (Style B), or set Service Code 60 to "0.1" to disable Fail contact output of PH201G (Style B).

| Code | Display | Function | Function detail | X | Y | Z | Default values | |
|---|---|---|---|---|---|---|---|---|
| **Communication** | | | | | | | | |
| 60 | *COMM. | Communication | Set HART communication Off<br>Set HART communication On<br>Set communication PH201G*B On<br>NA<br>NA | 0<br>1<br>2 | <br><br><br>0<br>1 | | 1.0 | On |

60.eps

## 13. APPENDIX 3 QUALITY INSPECTION

### 13-1. SC202G 2-Wire Conductivity Transmitter

# Quality Inspection Standards

# SC202G, SC202SJ 2-Wire Conductivity Transmitter

**1. Scope**

This inspection standard applies to the SC202/SC202SJ 2-Wire Conductivity Transmitter.

**2. Inspection Items**

2.1 Insulation resistance test
2.2 Current output test
2.3 Temperature indication check
2.4 Resistance (conductivity) check

**3. Inspection Methods, Standards and Conditions**

- Connect the testing circuit as shown in Figure 1. Allow the instrument to warm up for at least 5 minutes before conducting the tests. For the connections for the insulation resistance test, follow the instructions in Section 3.1.
- Performance tests should be done in the inspection mode where the tests from Section 3.2 through Section 3.4 take place in sequence and cannot be retraced. If the reconfirmation of a test is needed, turn off the power to the transmitter, turn on the power again, and enter the inspection mode to restart the tests.
- Set the equipment as follows.
  Decade resistance box 1 (temperature): 960.9 Ω
  Decade resistance box 2 (conductivity): 10 Ω
  DC source: 24 VDC

**3.1 Insulation Resistance Test**

As for the PH202G, follow the instructions below.

(1) Apply 500 V DC between the power supply terminals shorted together (+ and –) and the earth terminal (G). The insulation resistance must be 100 MΩ or greater.
(2) Apply 500 V DC between the input terminals shorted together (11 to 16) and the earth terminal (G). The insulation resistance must be 100 MΩ or greater.

As for the PH202SJ, follow the instructions below.

(1) Apply 125 V DC between the power supply terminals shorted together (+ and –) and the earth terminal (G). The insulation resistance must be 9.5 MΩ or greater.
(2) Apply 125 V DC between the input terminals shorted together (11 to 16) and the earth terminal (G). The insulation resistance must be 100 MΩ or greater.

**3.2 Current Output Test**

<Test>
(1) Enter Service Code 87 and then password 070.
(2) When the message display shows “*HIF”, press the [YES] key.
(3) Press the [ENT] key. (The date in day-month-year (last 2 digits) order will appear.)
(4) Press the [ENT] key. (The time in hour-minute-second order will appear.)
(5) Press the [ENT] key.
(6) When the message display shows “4 (mA),” the output current must be within the range shown in Table 1.
(7) After confirmation, press the [ENT] key.
(8) To skip the current output if not needed to be checked, just press the [ENT] key.

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6th Edition: Mar. 2007(YK)

(9) After the test at 20 mA, press the [ENT] key twice.

Table 1

| Current output (mA) | Current output (mA DC) |
|---|---|
| 4.0 | 4 ±0.02 |
| 12.0 | 12 ±0.02 |
| 20.0 | 20 ±0.02 |

### 3.3 Temperature Indication Check

(1) Check that the temperature sensor type indicated on the message display is “Pt1000.”
(2) Change the value of the decade resistance box 1 (temperature) as shown in Table 2 and check the data display. The temperature value on the data display must be within the range shown in Table 2.
(3) Press the [ENT] key until the message display shows “8k55.”
(4) Press the [ENT] key. A “*WAIT” message will flash.

Table 2

| Decade box 1 resistance (Ω) | Data display (°C) |
|---|---|
| 960.9 | -10 ±0.3 |
| 1289.8 | 75 ±0.3 |
| 1721.6 | 190 ±0.3 |
| 1904.6 (*) | 240 ±0.3 |

(*) This item is checked under measurement mode.

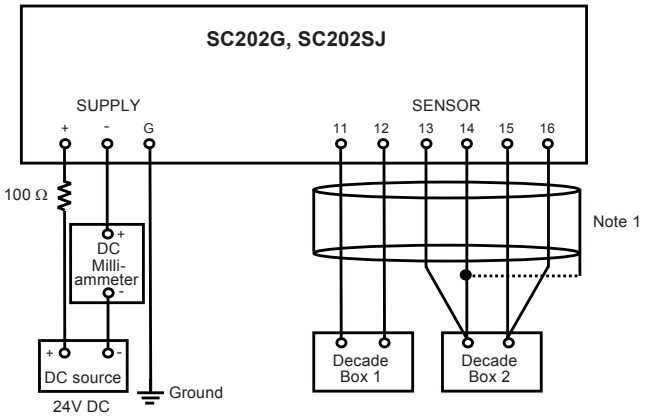
### 3.4 Resistance (Conductivity) Indication Check

(1) Check that in the message display “*WAIT” has disappeared and instead “RES.1” appears.
(2) Set decade resistance box 2 to 10 Ω and check the data display. The resistance must be within the range shown in Table 3.
(3) Press the [ENT] key. The message display will show “RES.2.”
(4) Set decade resistance box 2 to 100 Ω and check the data display. The resistance must be within the range shown in Table 3.
(5) Press the [ENT] key. The message display will show “RES.3.”
(6) Set decade resistance box 2 to 1 kΩ and check the data display. The resistance must be within the range shown in Table 3.
(7) Press the [ENT] key. The message display will show “RES.4.”
(8) Set decade resistance box 2 to 10 kΩ and check the data display. The resistance must be within the range shown in Table 3.
(9) Press the [ENT] key. The message display will show “RES.5.”
(10) Set decade resistance box 2 to 100 kΩ and check the data display. The resistance must be within the range shown in Table 3.
(11) Press the [ENT] key. The message display will show “READY.”
(12) Press the [ENT] key to restart the transmitter.

This completes all the tests.

Table 3

| Message display | Decade box 2 resistance | Data display |
|---|---|---|
| RES.1 | 10 Ω | 10.00 ±0.05 Ω |
| RES.2 | 100 Ω | 100.0 ±0.5 Ω |
| RES.3 | 1 kΩ | 1.000 ±0.005 kΩ |
| RES.4 | 10 kΩ | 10.00 ±0.05 kΩ |
| RES.5 | 100 kΩ | 100.0 ±0.5 kΩ |




Note 1: Cable connected to sensor input should be conductivity detector cable of length 2.1 ±0.1 m. Connect pins 13 and 14, also 15 and 16, to Decade box 2 terminals. Use shielded cable, and connect shield to pin 14.

**Figure 1 Testing Circuit and Test Equipment**

**QIS 12D08B02-01E**

# 成 績 表
## TEST CERTIFICATE

| | | | |
|---|---|---|---|
| 製品名称<br>PRODUCT NAME | 2線式導電率伝送器<br>Two-Wire Conductivity Transmitter | タグNo.<br>TAG NO. | |
| 形名<br>MODEL | SC202G,SC20SJ | | |
| 手配No.<br>ORDER NO. | | 計器番号<br>SERIAL NO. | |

| 検 査 項 目　INSPECTION ITEM | | 結 果 RESULT |
|---|---|---|
| 外　観<br>APPEARANCE | | |
| 絶縁抵抗<br>INSULATION RESISTANCE | 電源端子(＋, －) 一括とアース端子(G)間<br>□100MΩ以上 / 500V DC (SC202G)　□9.5MΩ以上 / 125V DC (SC202SJ)<br>BETWEEN POWER SUPPLY TERMINALS(+,-) AND EARTH TERMINAL(G)<br>□100MΩ OR MORE/500V DC (SC202G)　□9.5MΩ OR MORE/125V DC (SC202SJ) | |
| | 入力端子(11～16)一括とアース端子(G)間<br>□100MΩ以上 / 500V DC (SC202G)　□100MΩ以上 / 125V DC (SC202SJ)<br>BETWEEN INPUT TERMINALS(11 TO 16) AND EARTH TERMINAL(G)<br>□100MΩ OR MORE/500V DC (SC202G)　□100MΩ OR MORE/125V DC (SC202SJ) | |

電流出力 CURRENT OUTPUT

許容差 ACCURACY : ±0.02mA DC

| 表示 INDICATION (mA) | 出 力 OUTPUT (mA DC) 基準値 REF. | 実測値 ACTUAL | 誤差 ERROR |
|---|---|---|---|
| 4.0 | 4 | | |
| 12.0 | 12 | | |
| 20.0 | 20 | | |

温度表示 TEMPERATURE INDICATION

PT1000

| 抵抗値 RESISTANCE (Ω) | 表 示 INDICATION (℃) 基準値 REF. | 許容差 ACCURACY | 実測値 ACTUAL | 誤差 ERROR |
|---|---|---|---|---|
| 960.9 | −10 | ±0.3 | | |
| 1289.8 | 75 | ±0.3 | | |
| 1721.6 | 190 | ±0.3 | | |
| 1904.6 | 240 | ±0.3 | | |

抵抗表示 RESISTANCE INDICATION

| 抵抗値 RESISTANCE (Ω) | 表 示 INDICATION (Ω) 基準値 REF. | 許容差 ACCURACY | 実測値 ACTUAL | 誤差 ERROR |
|---|---|---|---|---|
| 10 | 10 | ±0.05 | | |
| 100 | 100 | ±0.5 | | |
| 1 k | 1k | ±0.005 k | | |
| 10 k | 10k | ±0.05 k | | |
| 100 k | 100k | ±0.5 k | | |

NOTES

| | |
|---|---|
| 日付<br>DATE | 室内温度・湿度<br>AMBIENT TEMP. & HUM. ℃ & % |
| 検査者<br>INSPECTOR | 承認者<br>APPROVED BY |

YOKOGAWA ◆

QIC−12D08B02−01
Ed6: Mar.2007

## 13-2. SC202S 2-Wire Conductivity Transmitter

# Quality Inspection Standards

# SC202S 2-Wire Conductivity Transmitter

### 1. Scope

This inspection standard applies to the SC202□ 2-Wire Conductivity Transmitter.

### 2. Inspection Items

2.1 Insulation resistance test
*2.2 Dielectric strength test
2.3 Current output test
2.4 Temperature indication check
2.5 Resistance (conductivity) check

Note: Items marked with an asterisk (*) may only be confirmed by a test certificate.

### 3. Inspection Methods, Standards and Conditions

- Connect the testing circuit as shown in Figure 1. Allow the instrument to warm up for at least 5 minutes before conducting the tests. For the connections for the insulation resistance test, follow the instructions in Section 3.1 and for the connections for the dielectric strength test, follow the instructions in Section 3.2.
- Performance tests should be done in the inspection mode where the tests from Section 3.3 through Section 3.5 take place in sequence and cannot be retraced. If the reconfirmation of a test is needed, turn off the power to the transmitter, turn on the power again, and enter the inspection mode to restart the tests.
- Set the equipment as follows.
  Decade resistance box 1 (temperature): 960.9 Ω
  Decade resistance box 2 (conductivity): 10 Ω
  DC source: 24 VDC

### 3.1 Insulation Resistance Test

(1) Apply 500 V DC between the power supply terminals shorted together (+ and –) and the earth terminal (G). The insulation resistance must be 100 MΩ or greater.
(2) Apply 500 V DC between the input terminals shorted together (11 to 16) and the earth terminal (G). The insulation resistance must be 100 MΩ or greater.

### 3.2 Dielectric strength test

Apply 600 V AC, an AC voltage of substantially sinusoidal waveform with a frequency of 50 Hz or 60 Hz, between the terminals shown below, for at least 2 seconds. The insulation must withstand this voltage. (The sensed current should be 10 mA.)

(1) Between the power supply terminals shorted together (+ and –) and the earth terminal (G)
(2) Between the input terminals shorted together (11 to 16) and the earth terminal (G)
(3) Between the input terminals shorted together (11 to 16) and the power supply terminals shorted together (+ and –)

### 3.3 Current Output Test

<Test>
(1) Enter Service Code 87 and then password 070.
(2) When the message display shows "*HIF", press the [YES] key.

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(3) Press the [ENT] key. (The date in day-month-year (last 2 digits) order will appear.)
(4) Press the [ENT] key. (The time in hour-minute-second order will appear.)
(5) Press the [ENT] key.
(6) When the message display shows “4 (mA),” the output current must be within the range shown in Table 1.
(7) After confirmation, press the [ENT] key.
(8) To skip the current output if not needed to be checked, just press the [ENT] key.
(9) After the test at 20 mA, press the [ENT] key twice.

Table 1

| Current output (mA) | Current output (mA DC) |
|---|---|
| 4.0 | 4 ±0.02 |
| 12.0 | 12 ±0.02 |
| 20.0 | 20 ±0.02 |

### 3.4 Temperature Indication Check

(1) Check that the temperature sensor type indicated on the message display is “Pt1000.”
(2) Change the value of the decade resistance box 1 (temperature) as shown in Table 2 and check the data display. The temperature value on the data display must be within the range shown in Table 2.
(3) Press the [ENT] key until the message display shows “8k55.”
(4) Press the [ENT] key. A “*WAIT” message will flash.

Table 2

| Decade box 1 resistance (Ω) | Data display (°C) |
|---|---|
| 960.9 | -10 ±0.3 |
| 1289.8 | 75 ±0.3 |
| 1721.6 | 190 ±0.3 |
| 1904.6 (*) | 240 ±0.3 |

(*) This item is checked under measurement mode.

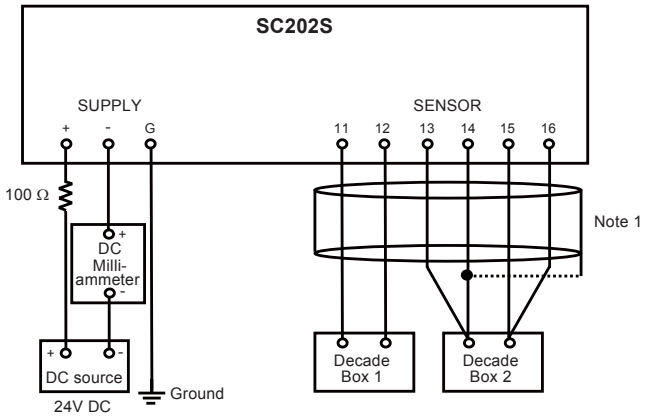
### 3.5 Resistance (Conductivity) Indication Check

(1) Check that in the message display “*WAIT” has disappeared and instead “RES.1” appears.
(2) Set decade resistance box 2 to 10 Ω and check the data display. The resistance must be within the range shown in Table 3.
(3) Press the [ENT] key. The message display will show “RES.2.”
(4) Set decade resistance box 2 to 100 Ω and check the data display. The resistance must be within the range shown in Table 3.
(5) Press the [ENT] key. The message display will show “RES.3.”
(6) Set decade resistance box 2 to 1 kΩ and check the data display. The resistance must be within the range shown in Table 3.
(7) Press the [ENT] key. The message display will show “RES.4.”
(8) Set decade resistance box 2 to 10 kΩ and check the data display. The resistance must be within the range shown in Table 3.
(9) Press the [ENT] key. The message display will show “RES.5.”
(10) Set decade resistance box 2 to 100 kΩ and check the data display. The resistance must be within the range shown in Table 3.
(11) Press the [ENT] key. The message display will show “READY.”
(12) Press the [ENT] key to restart the transmitter.

This completes all the tests.

Table 3

| Message display | Decade box 2 resistance | Data display |
|---|---|---|
| RES.1 | 10 Ω | 10.00 ±0.05 Ω |
| RES.2 | 100 Ω | 100.0 ±0.5 Ω |
| RES.3 | 1 kΩ | 1.000 ±0.005 kΩ |
| RES.4 | 10 kΩ | 10.00 ±0.05 kΩ |
| RES.5 | 100 kΩ | 100.0 ±0.5 kΩ |




Note 1: Cable connected to sensor input should be conductivity detector cable of length 2.1 ±0.1 m. Connect pins 13 and 14, also 15 and 16, to Decade box 2 terminals. Use shielded cable, and connect shield to pin 14.

**Figure 1 Testing Circuit and Test Equipment**

# 成 績 表
## TEST CERTIFICATE

| | | | |
|---|---|---|---|
| 製品名称<br>PRODUCT NAME | 2線式導電率伝送器<br>Two-Wire Conductivity Transmitter | タグNo.<br>TAG NO. | |
| 形名<br>MODEL | SC202S | | |
| 手配No.<br>ORDER NO. | | 計器番号<br>SERIAL NO. | |

| 検 査 項 目 INSPECTION ITEM | | 結 果 RESULT |
|---|---|---|
| 外 観<br>APPEARANCE | | |
| 絶縁抵抗<br>INSULATION RESISTANCE | 電源端子(＋, －) 一括とアース端子(G)間<br>100MΩ以上 / 500V DC<br>BETWEEN POWER SUPPLY TERMINALS(+,−) AND EARTH TERMINAL(G)<br>100MΩ OR MORE/500V DC | |
| | 入力端子(11～16)一括とアース端子(G)間<br>100MΩ以上 / 500V DC<br>BETWEEN INPUT TERMINALS(11 TO 16) AND EARTH TERMINAL(G)<br>100MΩ OR MORE/500V DC | |
| 耐電圧<br>DIELECTRIC STRENGTH | 電源端子(＋, －) 一括とアース端子(G)間 600V AC/2秒<br>BETWEEN POWER SUPPLY TERMINALS(+,−) AND EARTH TERMINAL(G)<br>600V AC/2 SEC | |
| | 入力端子(11～16)一括とアース端子(G)間 600V AC/2秒<br>BETWEEN INPUT TERMINALS(11 TO 16) AND EARTH TERMINAL(G)<br>600V AC/2 SEC | |
| | 入力端子(11～16)一括と電源端子(＋, －) 一括間 600V AC/2秒<br>BETWEEN INPUT TERMINALS(11 TO 16) AND POWER SUPPLY TERMINALS(+,−)<br>600V AC/2 SEC | |

電流出力 CURRENT OUTPUT

許容差 ACCURACY : ±0.02mA DC

| 表示 INDICATION (mA) | 出 力 OUTPUT (mA DC) | | |
|---|---|---|---|
| | 基準値 REF. | 実測値 ACTUAL | 誤差 ERROR |
| 4.0 | 4 | | |
| 12.0 | 12 | | |
| 20.0 | 20 | | |

温度表示 TEMPERATURE INDICATION

PT1000

| 抵抗値 RESISTANCE (Ω) | 表 示 INDICATION (℃) | | | |
|---|---|---|---|---|
| | 基準値 REF. | 許容差 ACCURACY | 実測値 ACTUAL | 誤差 ERROR |
| 960.9 | −10 | ±0.3 | | |
| 1289.8 | 75 | ±0.3 | | |
| 1721.6 | 190 | ±0.3 | | |
| 1904.6 | 240 | ±0.3 | | |

抵抗表示 RESISTANCE INDICATION

| 抵抗値 RESISTANCE (Ω) | 表 示 INDICATION (Ω) | | | |
|---|---|---|---|---|
| | 基準値 REF. | 許容差 ACCURACY | 実測値 ACTUAL | 誤差 ERROR |
| 10 | 10 | ±0.05 | | |
| 100 | 100 | ±0.5 | | |
| 1 k | 1k | ±0.005 k | | |
| 10 k | 10k | ±0.05 k | | |
| 100 k | 100k | ±0.5 k | | |

NOTES

| | |
|---|---|
| 日付<br>DATE | 室内温度・湿度<br>AMBIENT TEMP. & HUM. ℃ & % |
| 検査者<br>INSPECTOR | 承認者<br>APPROVED BY |

YOKOGAWA ◆

QIC−12D08B02−21
Ed1: Mar.2007

## 13-3. SC202G, SC202S 2-Wire Conductivity Transmitter (Fieldbus Communication)

# Quality Inspection Standards

# SC202G, SC202S 2-Wire Conductivity Transmitter (Fieldbus Communication)

### 1. Scope

This inspection standard applies to the SC202G and SC202S 2-Wire Conductivity Transmitters (Fieldbus specification).

### 2. Inspection Items

2.1 Insulation resistance test
*2.2 Dielectric strength test
2.3 Temperature indication check
2.4 Conductivity indication check
*2.5 Fieldbus communication functional check

Note: Items marked with an asterisk (*) may only be confirmed by a test certificate.

### 3. Inspection Methods, Standards and Conditions

- Connect the testing circuit as shown in Figure 1. Allow the instrument to warm up for at least 5 minutes before conducting the tests. For the connections for the insulation resistance test, follow the instructions in Section 3.1 and for the connections for the dielectric strength test, follow the instructions in Section 3.2.
- Use test equipment shown in Figure 1, or equivalent, for the tests.

### 3.1 Insulation Resistance Test

(1) Apply 500 V DC between the power supply terminals shorted together (+ and –) and the earth terminal (G). The insulation resistance must be 100 MΩ or greater.

(2) Apply 500 V DC between the input terminals shorted together (11 to 16) and the earth terminal (G). The insulation resistance must be 100 MΩ or greater.

### 3.2 Dielectric Strength Test (Required Only for SC202S)

Apply 600 V AC, an AC voltage of substantially sinusoidal waveform with a frequency of 50 Hz or 60 Hz, between the terminals shown below, for at least 2 seconds. The insulation must withstand this voltage. (The sensed current should be 10 mA.)

(1) Between the power supply terminals shorted together (+ and –) and the earth terminal (G)

(2) Between the input terminals shorted together (11 to 16) and the earth terminal (G)

(3) Between the input terminals shorted together (11 to 16) and the power supply terminals shorted together (+ and –)

### 3.3 Temperature Indication Check

Connect the instruments as shown in Figure 1, and set them as follows.

Decade resistance box 1: 960.9 Ω
Decade resistance box 2: 10 Ω

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In this state, change the resistance value of the decade resistance box 1 as shown in Table 1. The corresponding temperature indication must be within the range.

Table 1 Temperature Indication Check

| Reference Temperature | Resistance of Resistance Box 1 | Indication Range |
|---|---|---|
| –10 °C | 960.9 Ω | –10 ±0.3 °C |
| 75 °C | 1289.8 Ω | 75 ±0.3 °C |
| 190 °C | 1721.6 Ω | 190 ±0.3 °C |
| 240 °C | 1904.6 Ω | 240 ±0.3 °C |

### 3.4 Conductivity Indication Check

Connect the instruments as shown in Figure 1, and set them as follows.
Decade resistance box 1: 100 Ω
Decade resistance box 2: 10 Ω

In this state, change the resistance value of the decade resistance box 2 as shown in Table 2. The corresponding conductivity indication must be within the range.

Table 2 Conductivity Indication Check (Cell Constant : 0.1/cm)

| Reference Conductivity | Resistance of Resistance Box 2 | Indication Range |
|---|---|---|
| 10 mS/cm | 10 Ω | 10 ±0.05 mS/cm |
| 1 mS/cm | 100 Ω | 1 ±0.005 mS/cm |
| 100 µS/cm | 1 kΩ | 100 ±0.5 µS/cm |
| 10 µS/cm | 10 kΩ | 10 ±0.05 µS/cm |
| 1 µS/cm | 100 kΩ | 1 ±0.005 µS/cm |

### 3.5 Fieldbus Communication Functional Check

Check for normal function using Fieldbus equipment specified by Yokogawa.

3/3

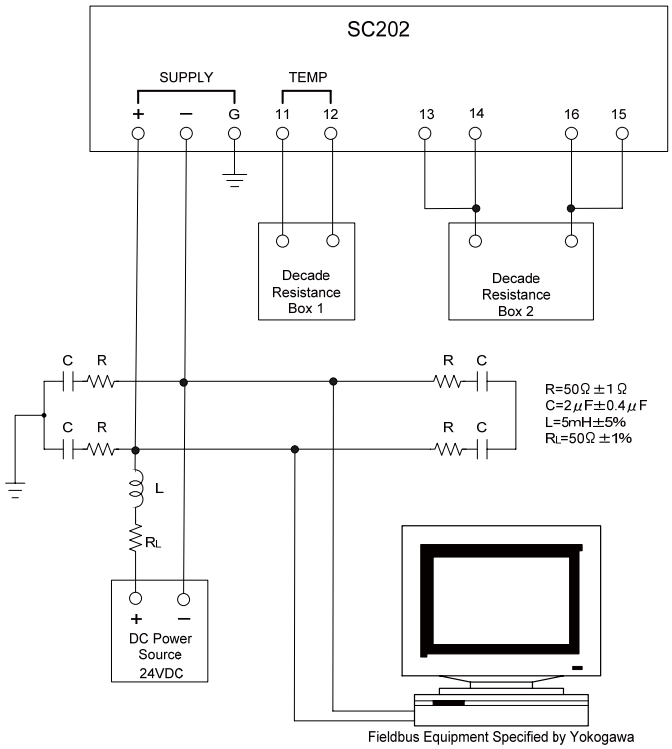


**Figure 1 Testing Circuit and Test Equipment**

**QIS 12D08B02-61E**

# 成 績 表
## TEST CERTIFICATE

| | | | |
|---|---|---|---|
| 製品名称<br>PRODUCT NAME | 2線式導電率伝送器<br>Two-Wire Conductivity Transmitter | タグNo.<br>TAG NO. | |
| 形名<br>MODEL | SC202 | | |
| 手配No.<br>ORDER NO. | | 計器番号<br>SERIAL NO. | |

| 検査項目 INSPECTION ITEM | | 結果 RESULT |
|---|---|---|
| 外観<br>APPEARANCE | | |
| 絶縁抵抗<br>INSULATION RESISTANCE | 電源端子(＋, －) 一括とアース端子(G)間 100MΩ以上 / 500V DC<br>BETWEEN POWER SUPPLY TERMINALS(+,−) AND EARTH TERMINAL(G) 100MΩ OR MORE/500V DC | |
| | 入力端子(11～16)一括とアース端子(G)間 100MΩ以上 / 500V DC<br>BETWEEN INPUT TERMINALS(11 TO 16) AND EARTH TERMINAL(G) 100MΩ OR MORE/500V DC | |
| 耐電圧<br>DIELECTRIC STRENGTH<br>(SC202Sのみ)<br>(ONLY FOR SC202S) | 電源端子(＋, －) 一括とアース端子(G)間 600V/2秒間<br>BETWEEN POWER SUPPLY TERMINALS(+,−) AND EARTH TERMINAL(G) 600V AC/2 SEC | |
| | 入力端子(11～16) 一括とアース端子(G)間 600V/2秒間<br>BETWEEN INPUT TERMINALS(11 TO 16) AND EARTH TERMINAL(G) 600V AC/2 SEC | |
| | 入力端子(11～16) 一括と電源端子(＋、－)間 600V/2秒間<br>BETWEEN INPUT TERMINALS(11 TO 16) AND POWER SUPPLY TERMINALS(+,−) 600V AC/2 SEC | |

温度表示 TEMPERATURE INDICATION

PT1000

| 抵抗値 RESISTANCE (Ω) | 表示 INDICATION (℃) 基準値 REF. | 許容差 ACCURACY | 実測値 ACTUAL | 誤差 ERROR |
|---|---|---|---|---|
| 960.9 | −10 | ±0.3 | | |
| 1289.8 | 75 | ±0.3 | | |
| 1721.6 | 190 | ±0.3 | | |
| 1904.6 | 240 | ±0.3 | | |

導電率表示 CONDUCTIVITY INDICATION

| 抵抗値 RESISTANCE (Ω) | 表示 INDICATION 基準値 REF. | 許容差 ACCURACY | 実測値 ACTUAL | 誤差 ERROR |
|---|---|---|---|---|
| 10 | 10 mS/cm | ±0.05 mS/cm | | |
| 100 | 1 mS/cm | ±0.005 mS/cm | | |
| 1k | 100 μS/cm | ±0.5 μS/cm | | |
| 10k | 10 μS/cm | ±0.05 μS/cm | | |
| 100k | 1 μS/cm | ±0.005 μS/cm | | |

| | |
|---|---|
| フィールドバス機能<br>FIELDBUS FUNCTION | フィールドバス機能確認<br>FIELDBUS FUNCTION CHECK |

NOTES

| | |
|---|---|
| 日付<br>DATE | 室内温度・湿度<br>AMBIENT TEMP. & HUM. ℃ & % |
| 検査者<br>INSPECTOR | 承認者<br>APPROVED BY |

YOKOGAWA ◆

QIC-12D08B02-61
Ed1 Apr. 2007

## 13-4. SC202G, SC202S 2-Wire Conductivity Transmitter (Profibus Communication)

# Quality Inspection Standards

# SC202G, SC202S 2-Wire Conductivity Transmitter (Profibus Communication)

### 1. Scope

This inspection standard applies to the SC202G and SC202S 2-Wire Conductivity Transmitters (Profibus specification).

### 2. Inspection Items

2.1 Insulation resistance test
*2.2 Dielectric strength test
2.3 Temperature indication check
2.4 Conductivity indication check
*2.5 Profibus communication functional check

Note: Items marked with an asterisk (*) may only be confirmed by a test certificate.

### 3. Inspection Methods, Standards and Conditions

- Connect the testing circuit as shown in Figure 1. Allow the instrument to warm up for at least 5 minutes before conducting the tests. For the connections for the insulation resistance test, follow the instructions in Section 3.1 and for the connections for the dielectric strength test, follow the instructions in Section 3.2.
- Use test equipment shown in Figure 1, or equivalent, for the tests.

### 3.1 Insulation Resistance Test

(1) Apply 500 V DC between the power supply terminals shorted together (+ and –) and the earth terminal (G). The insulation resistance must be 100 MΩ or greater.

(2) Apply 500 V DC between the input terminals shorted together (11 to 16) and the earth terminal (G). The insulation resistance must be 100 MΩ or greater.

### 3.2 Dielectric Strength Test (Required Only for SC202S)

Apply 600 V AC, an AC voltage of substantially sinusoidal waveform with a frequency of 50 Hz or 60 Hz, between the terminals shown below, for at least 2 seconds. The insulation must withstand this voltage. (The sensed current should be 10 mA.)

(1) Between the power supply terminals shorted together (+ and –) and the earth terminal (G)

(2) Between the input terminals shorted together (11 to 16) and the earth terminal (G)

(3) Between the input terminals shorted together (11 to 16) and the power supply terminals shorted together (+ and –)

### 3.3 Temperature Indication Check

Connect the instruments as shown in Figure 1, and set them as follows.

Decade resistance box 1: 960.9 Ω
Decade resistance box 2: 10 Ω

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1st Edition: Sep. 2007

In this state, change the resistance value of the decade resistance box 1 as shown in Table 1. The corresponding temperature indication must be within the range.

Table 1 Temperature Indication Check

| Reference Temperature | Resistance of Resistance Box 1 | Indication Range |
|---|---|---|
| –10 °C | 960.9 Ω | –10 ±0.3 °C |
| 75 °C | 1289.8 Ω | 75 ±0.3 °C |
| 190 °C | 1721.6 Ω | 190 ±0.3 °C |
| 240 °C | 1904.6 Ω | 240 ±0.3 °C |

### 3.4 Conductivity Indication Check

Connect the instruments as shown in Figure 1, and set them as follows.
Decade resistance box 1: 100 Ω
Decade resistance box 2: 10 Ω

In this state, change the resistance value of the decade resistance box 2 as shown in Table 2. The corresponding conductivity indication must be within the range.

Table 2 Conductivity Indication Check (Cell Constant : 0.1/cm)

| Reference Conductivity | Resistance of Resistance Box 2 | Indication Range |
|---|---|---|
| 10 mS/cm | 10 Ω | 10 ±0.05 mS/cm |
| 1 mS/cm | 100 Ω | 1 ±0.005 mS/cm |
| 100 µS/cm | 1 kΩ | 100 ±0.5 µS/cm |
| 10 µS/cm | 10 kΩ | 10 ±0.05 µS/cm |
| 1 µS/cm | 100 kΩ | 1 ±0.005 µS/cm |

### 3.5 Profibus Communication Functional Check

Check for normal function using Profibus equipment specified by Yokogawa.
In the tests of Item 3.3 to 3.4, check the communication function using Profibus communication.

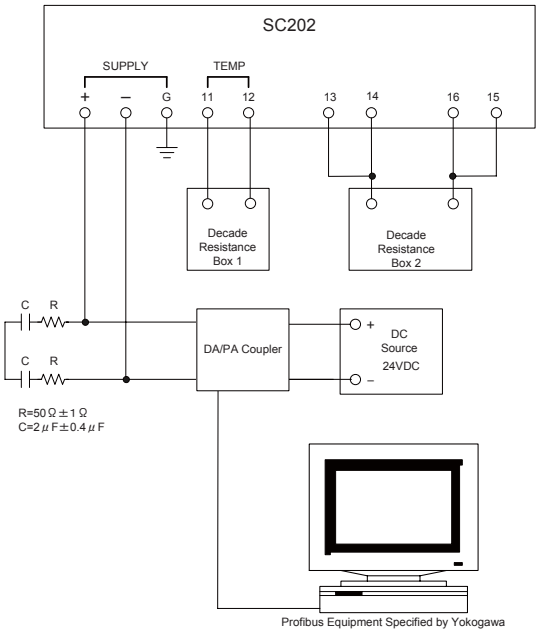


**Figure 1 Testing Circuit and Test Equipment**

# 成 績 表
## TEST CERTIFICATE

| | | | |
|---|---|---|---|
| 製品名称<br>PRODUCT NAME | 2線式導電率伝送器<br>Two-Wire Conductivity Transmitter | タグNo.<br>TAG NO. | |
| 形名<br>MODEL | SC202 | | |
| 手配No.<br>ORDER NO. | | 計器番号<br>SERIAL NO. | |

| 検査項目 INSPECTION ITEM | | 結果 RESULT |
|---|---|---|
| 外観<br>APPEARANCE | | |
| 絶縁抵抗<br>INSULATION RESISTANCE | 電源端子(＋, －) 一括とアース端子(G)間 100MΩ以上 / 500V DC<br>BETWEEN POWER SUPPLY TERMINALS(+,-) AND EARTH TERMINAL(G) 100MΩ OR MORE/500V DC | |
| | 入力端子(11～16)一括とアース端子(G)間 100MΩ以上 / 500V DC<br>BETWEEN INPUT TERMINALS(11 TO 16) AND EARTH TERMINAL(G) 100MΩ OR MORE/500V DC | |
| 耐電圧<br>DIELECTRIC STRENGTH<br>(SC202Sのみ)<br>(ONLY FOR SC202S) | 電源端子(＋, －) 一括とアース端子(G)間 600V/2秒間<br>BETWEEN POWER SUPPLY TERMINALS(+,-) AND EARTH TERMINAL(G) 600V AC/2 SEC | |
| | 入力端子(11～16) 一括とアース端子(G)間 600V/2秒間<br>BETWEEN INPUT TERMINALS(11 TO 16) AND EARTH TERMINAL(G) 600V AC/2 SEC | |
| | 入力端子(11～16) 一括と電源端子(＋、－)間 600V/2秒間<br>BETWEEN INPUT TERMINALS(11 TO 16) AND POWER SUPPLY TERMINALS(+,-) 600V AC/2 SEC | |

温度表示 TEMPERATURE INDICATION

PT1000

| 抵抗値 RESISTANCE (Ω) | 表示 INDICATION (℃) 基準値 REF. | 許容差 ACCURACY | 実測値 ACTUAL | 誤差 ERROR |
|---|---|---|---|---|
| 960.9 | -10 | ±0.3 | | |
| 1289.8 | 75 | ±0.3 | | |
| 1721.6 | 190 | ±0.3 | | |
| 1904.6 | 240 | ±0.3 | | |

導電率表示 CONDUCTIVITY INDICATION

| 抵抗値 RESISTANCE (Ω) | 表示 INDICATION 基準値 REF. | 許容差 ACCURACY | 実測値 ACTUAL | 誤差 ERROR |
|---|---|---|---|---|
| 10 | 10 mS/cm | ±0.05 mS/cm | | |
| 100 | 1 mS/cm | ±0.005 mS/cm | | |
| 1k | 100 μS/cm | ±0.5 μS/cm | | |
| 10k | 10 μS/cm | ±0.05 μS/cm | | |
| 100k | 1 μS/cm | ±0.005 μS/cm | | |

| | | | |
|---|---|---|---|
| プロフィバス機能<br>PROFIBUS FUNCTION | プロフィバス機能確認<br>PROFIBUS FUNCTION CHECK | | |

NOTES

| | | | |
|---|---|---|---|
| 日付<br>DATE | | 室内温度・湿度<br>AMBIENT TEMP. & HUM. | ℃ & % |
| 検査者<br>INSPECTOR | | 承認者<br>APPROVED BY | |

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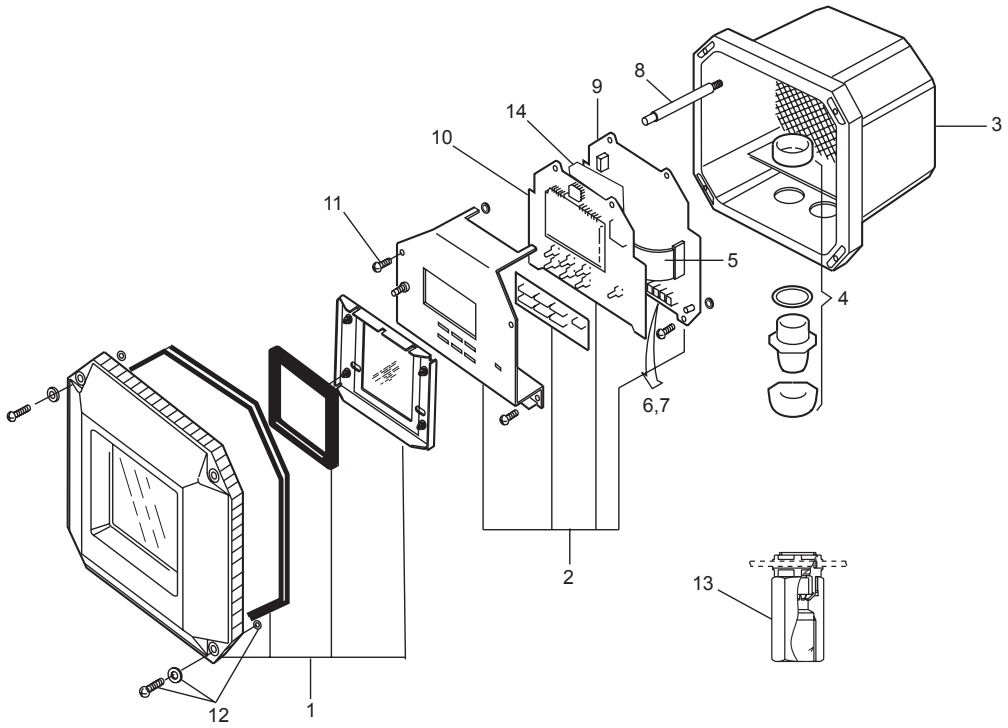
QIC-12D08B02-71
Ed1 Sep. 2007

# Customer Maintenance Parts List

## Model SC202G [Style: S3]
## Conductivity and Resistivity Transmitter




| Item | Part No. | Qty | Description |
|---|---|---|---|
| 1 | —— | | Cover Assembly |
| | K9315CA | 1 | Polyurethane Coating |
| | K9315CN | 1 | Epoxy-polyester Coating |
| 2 | —— | | Internal Works Assembly with amplifier assembly |
| | K9661CD | 1 | For mA + HART |
| | K9661CE | 1 | For FF |
| | K9661CF | 1 | For Profibus |
| 3 | —— | | Housing Assembly |
| | K9661HA | 1 | Polyurethane Coating |
| | K9661HB | 1 | Epoxy-polyester Coating |
| 4 | L9811FV | 2 | Cable Gland Assembly |
| 5 | K9660AQ | 1 | Flat Cable |
| 6 | A1726JD | 1 | Pin Terminal Unit 3 terminals type |
| 7 | K9184AA | 1 | Screw Terminal Unit when /TB specified |
| 8 | K9661HR | 2 | Stud |
| *9 | —— | | Analog Board Assembly |
| | K9661SA | 1 | For mA + HART |
| | K9661SC | 1 | For FF/Profibus |
| *10 | —— | 1 | Digital/Display Board |
| | K9661CV | 1 | For mA + HART |
| | K9661CW | 1 | For FF/Profibus |
| 11 | K9660YQ | 1 | Screw Assembly to fix amplifier |
| 12 | K9660YP | 1 | Stainless steel screw assembly to fix cover |
| 13 | —— | | Adapter Assembly |
| | K9414DH | 1 | For G1/2 screw when /AFTG specified (2 units). |
| | K9414DJ | 1 | For 1/2NPT screw when /ANSI specified (2 units). |
| *14 | —— | | Comm. Board Assembly |
| | K9661MC | 1 | For FF |
| | K9661NC | 1 | For Profibus |

* Do not exchange these parts. Call service personnel.

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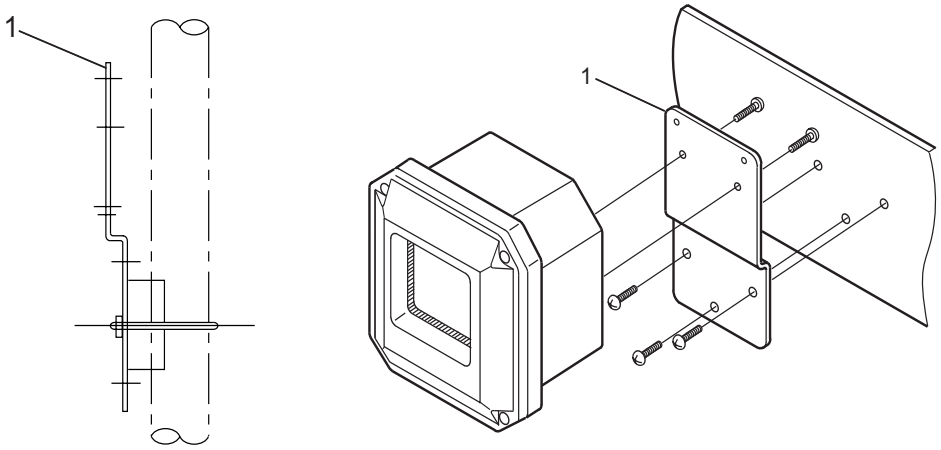
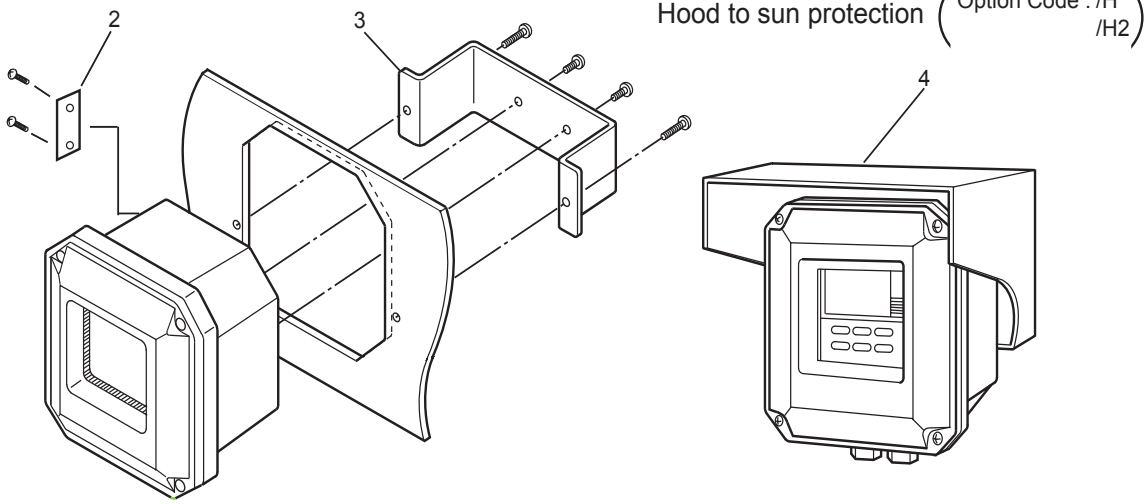
## Pipe/Wall Mounting Hardware (Option Code : /U)




## Panel Mounting Hardware

(Option Code : /SCT)

Hood to sun protection (Option Code : /H /H2)

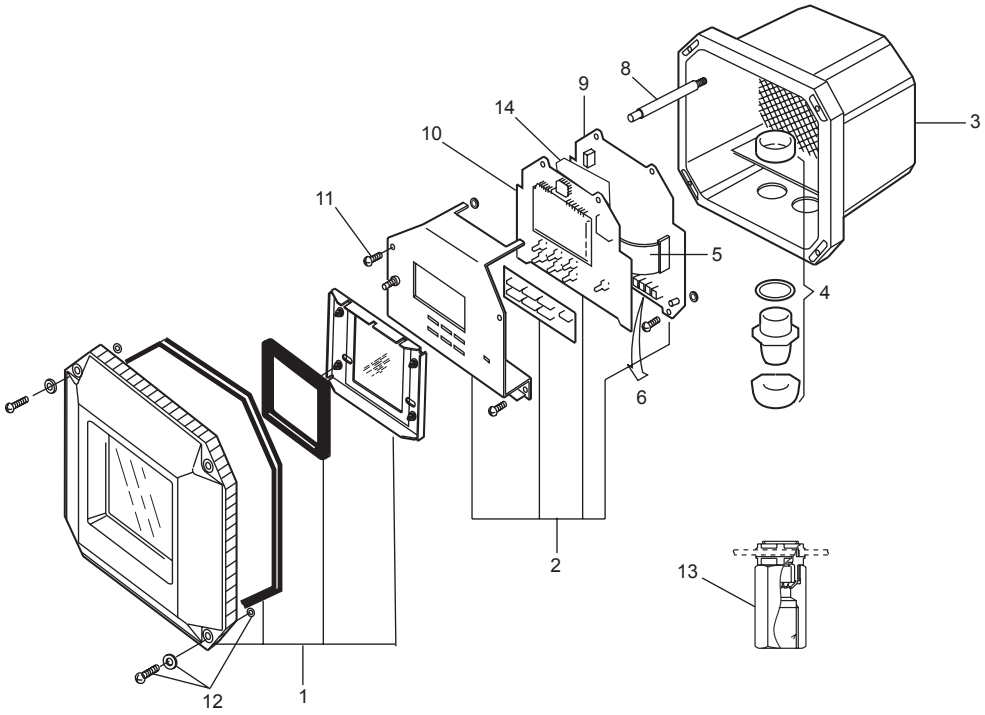



(Option Code : /PM)

| Item | Parts No. | Qty | Description |
|---|---|---|---|
| 1 | K9171SS | 1 | Universal Mount Set (/U) |
| 2 | K9311BT | 1 | Tag Plate (/SCT) |
| 3 | K9311KA | 1 | Fitting Assembly (/PM) |
| 4 | K9311KG | 1 | Hood Assembly (/H) |
| | K9660JA | 1 | Hood Assembly (/H2) |

# Customer Maintenance Parts List

## Model SC202S [Style : S3]
## Conductivity and Resistivity Transmitter




| Item | Part No. | Qty | Description |
|---|---|---|---|
| 1 | — | | Cover Assembly |
| | K9315CA | 1 | Polyurethane Coating |
| | K9315CN | 1 | Epoxy-polyester Coating |
| 2 | — | | Internal Works Assembly with amplifier assembly |
| | — | 1 | For mA + HART |
| | — | 1 | For FF |
| | — | 1 | For Profibus |
| | — | 1 | For mA + HART (Non-incendive) |
| 3 | — | | Housing Assembly |
| | — | 1 | Polyurethane Coating |
| | — | 1 | Epoxy-polyester Coating |
| 4 | L9811FV | 2 | Cable Gland Assembly |
| 5 | — | 1 | Flat Cable |
| 6 | — | 1 | Pin Terminal Unit 3 terminals type |
| 8 | — | 2 | Stud |
| 9 | — | | Analog Board Assembly |
| | — | 1 | For mA + HART |
| | — | 1 | For FF/Profibus |
| | — | 1 | For mA + HART (Non-incendive) |
| 10 | — | 1 | Digital/Display Board |
| | — | 1 | For mA + HART |
| | — | 1 | For FF/Profibus |
| 11 | | 1 | Screw Assembly to fix amplifier |
| 12 | K9660YP | 1 | Stainless steel screw asssembly to fix cover |
| 13 | — | | Adapter Assembly |
| | K9414DH | 1 | For G1/2 screw when /AFTG specified (2 units). |
| | K9414DJ | 1 | For 1/2NPT screw when /ANSI specified (2 units). |
| 14 | — | | Comm. Board Assembly |
| | — | 1 | For FF |
| | — | 1 | For Profibus |

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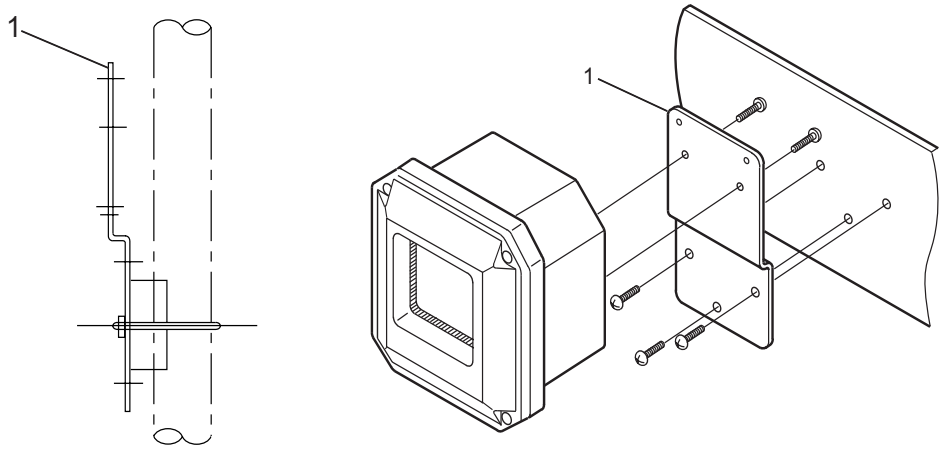
CMPL 12D08B02-23E
2nd Edition : Nov.2008 (YK)

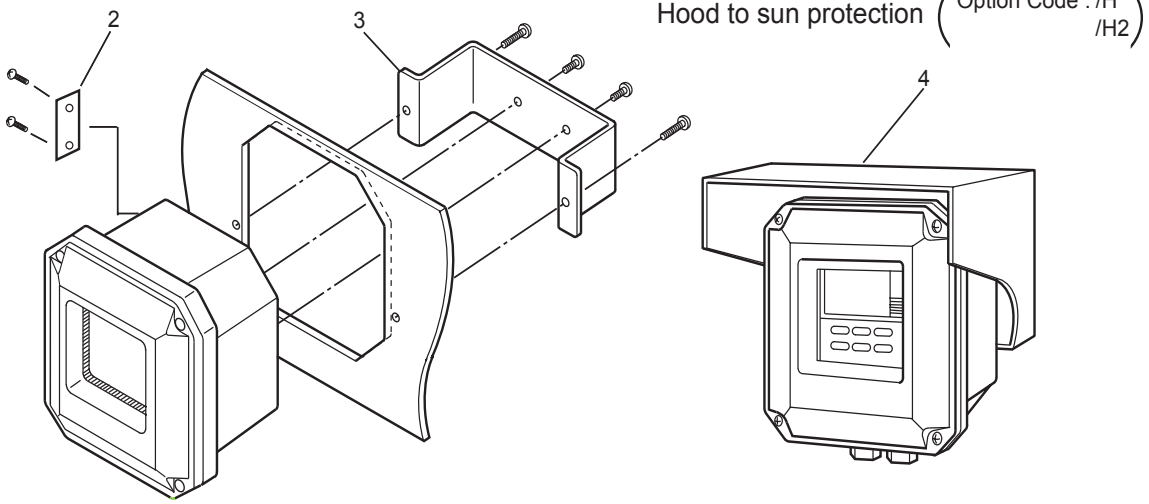
## Pipe/Wall Mounting Hardware (Option Code : /U)




## Panel Mounting Hardware

(Option Code : /SCT)

Hood to sun protection (Option Code : /H /H2)




(Option Code : /PM)

| Item | Parts No. | Qty | Description |
|---|---|---|---|
| 1 | K9171SS | 1 | Universal Mount Set (/U) |
| 2 | K9311BT | 1 | Tag Plate (/SCT) |
| 3 | K9311KA | 1 | Fitting Assembly (/PM) |
| 4 | K9311KG | 1 | Hood Assembly (/H) |
| | K9660JA | 1 | Hood Assembly (/H2) |

# Revision Record

Manual Title : Model SC202G [Style: S3], SC202S [Style: S3]
2-wire Conductivity or Resistivity Transmitter
Manual Number : IM 12D08B02-01E

| Edition | Date | Remark (s) |
|---|---|---|
| 1st | Feb. 2001 | Newly published |
| 2nd | Feb. 2004 | Style of SC202G changed to S2. |
| 3rd | May. 2004 | HART function is additionally described over all. |
| 4th | Mar. 2005 | Intrinsically safe type transmitter SC202SJ [Style: S1] added. |
| 5th | Mar. 2007 | All over revised. SC202SJ's IM separated to IM 12D08B02-11E.<br>Style of SC202G changed to S3, style of SC202S changed to S2. |
| 6th | Oct. 2007 | PREFACE-1, Some of warning description modified; P. 1-1, Some of nameplate in Figure 1-1 changed; P. 1-2, Some of nameplate in Figure 1-2 changed; P. 2-2, EN 61000-3-3 deleted from "I. Regulatory compliance."; P. 2-3, Certificate no. of CENELEC ATEX and IECEx Scheme explosionproof added, CSA explosionproof description added; P. 2-4, P. layout changed; P. 2-5, Note added to Model and suffix codes; P. 2-8, Control Drawing for mA HART Specification (FM Intrinsically safe design) corrected; P. 2-9, Control Drawing for mA HART Specification (FM Non-incendive design) corrected; P. 2-10, Control Drawing for mA HART Specification (CSA) corrected; P. 2-11, Control Drawing for FF/PB Specification (IECEx) corrected; P. 2-12, Control Drawing for FF/PB Specification (ATEX) corrected; P. 2-13, Control Drawing for FF/PB Specification (FM Intrinsically safe Entity) corrected; P. 2-15, Control Drawing for FF/PB Specification (FM Intrinsically safe FISCO) corrected; P. 2-17, Control Drawing for FF/PB Specification (FM Non-incendive Entity) corrected; P. 2-18, Control Drawing for FF/PB Specification (FM Non-incendive FNICO) corrected; P. 2-19, Control Drawing for FF/PB Specification (CSA) corrected; P. 5-8, Subsection 5-3, "Notes for guidance in the use of service code settings:" Added some cautions; Sec. 13 APPENDIX 3 QUALITY INSPECTION added; CMPL 12D08B02-03E, -22E revised to 2nd edition because some part no. changed. |
| 7th | Apr. 2008 | Style of SC202S changed to S3 and related description changed as follows. P.2-5, Style of SC202S changed to S3 for FM approval; P.3-1, Some of dimensions in Figure 3-1 corrected; P.5-9, NOTE to confirm zero offset after *AIR operation added to code 04; P.1-7 (Appendix), Note of HART protrocol DD files URL added; CMPL 12D08B02-23E 1st edition added for SC202S style S3. |

| Edition | Date | Remark (s) |
|---|---|---|
| 8th | Oct. 2009 | PREFACE, "Zone 0" added to Warning label explanation; P.1-1, Name plate of SC202S-K (NEPSI) added to Figure 1-1; P.2-2, Some revision of I. Regulatory compliance (description for EMC revised); P.2-3 to 2-4, Some revision of IECEx Intrinsically safe description ("Zone 0" added), and NEPSI Certification added to page 2-3 and 2-4; P.2-5, NEPSI suffix code of "-K" added to the SC202S MS-code; CMPL 12D08B02-23E of SC202S(S3) revised to 2nd edition (some parts no. deleted). |

# User's Manual

## Model SC202G [Style: S3], SC202S [Style: S3]
# 2-wire Conductivity or Resistivity Transmitter

**Supplement**

Thank you for selecting our Model SC202G [Style: S3] and/or SC202S [Style: S3] 2-Wire Conductivity or Resistivity Transmitter.
User's Manual, IM 12D08B02-01E, 8th Edition, supplied with the product, some revisions/additions have been made. Please replace the corresponding pages in your copy with the attached, revised pages.

Revisions:
- PREFACE, "How to dispose the batteries" added.
- Page 2-2, Description of Profibus added to EMC conformity standard.
- Last page, Added of KC mark.

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IM 12D08B02-01E
8th Edition

## DANGER

**Electric discharge**

The EXA analyzer contains devices that can be damaged by electrostatic discharge. When servicing this equipment, please observe proper procedures to prevent such damage. Replacement components should be shipped in conductive packaging. Repair work should be done at grounded workstations using grounded soldering irons and wrist straps to avoid electrostatic discharge.

**Installation and wiring**

The EXA analyzer should only be used with equipment that meets the relevant international and regional standards. Yokogawa accepts no responsibility for the misuse of this unit.

## CAUTION

The instrument is packed carefully with shock absorbing materials, nevertheless, the instrument may be damaged or broken if subjected to strong shock, such as if the instrument is dropped. Handle with care.

Although the instrument has a weatherproof construction, the transmitter can be harmed if it becomes submerged in water or becomes excessively wet.

Do not use an abrasive material or solvent when cleaning the instrument.

Do not modify the SC202 transmitter.

## WARNING

Electrostatic charge may cause an explosion hazard. Avoid any actions that cause the generation of electrostatic charge, e.g., rubbing with a dry cloth.

**Warning label**

Because the enclosure of the Dissolved Oxygen transmitter Type SC202S-A, -P, -F are made of aluminium, if it is mounted in an area where the use of category 1 G Zone 0 apparatus is required, it must be installed such, that, even in the event of rare incidents, ignition sources due to impact and friction sparks are excluded.

**Notice**

- This manual should be passed on to the end user.
- The contents of this manual are subject to change without prior notice.
- The contents of this manual shall not be reproduced or copied, in part or in whole, without permission.
- This manual explains the functions contained in this product, but does not warrant that they are suitable the particular purpose of the user.
- Every effort has been made to ensure accuracy in the preparation of this manual. However, when you realize mistaken expressions or omissions, please contact the nearest Yokogawa Electric representative or sales office.
- This manual does not cover the special specifications. This manual may be left unchanged on any change of specification, construction or parts when the change does not affect the functions or performance of the product.
- If the product is not used in a manner specified in this manual, the safety of this product may be impaired.

Yokogawa is not responsible for damage to the instrument, poor performance of the instrument or losses resulting from such, if the problems are caused by:

- Improper operation by the user.
- Use of the instrument in improper applications
- Use of the instrument in an improper environment or improper utility program
- Repair or modification of the related instrument by an engineer not authorized by Yokogawa.

**Safety and Modification Precautions**

- Follow the safety precautions in this manual when using the product to ensure protection and safety of the human body, the product and the system containing the product.

**How to dispose the batteries:**

This is an explanation about the new EU Battery Directive (DIRECTIVE 2006/66/EC). This directive is only valid in the EU. Batteries are included in this product. Batteries incorporated into this product cannot be removed by yourself. Dispose them together with this product. When you dispose this product in the EU, contact your local Yokogawa Europe B.V.office. Do not dispose them as domestic household waste.

Battery type: silver oxide battery

Notice:

The symbol (see above) means they shall be sorted out and collected as ordained in ANNEX II in DIRECTIVE 2006/66/EC.

## 2-2. Operating specifications

**A. Performance** (under reference conditions with sensor simulation)

**Conductivity** (2 µS x K cm$^{-1}$ to 200 mS x K cm$^{-1}$)
- Accuracy : ±0.5% F.S.

**Conductivity** (1 µS x K cm$^{-1}$ to 2 µS x K cm$^{-1}$)
- Accuracy : ±1% F.S.

**Resistivity** (0.005kΩ/ K cm$^{-1}$ to 0.5MΩ/ K cm$^{-1}$)
- Accuracy : ±0.5% F.S.

**Resistivity** (0.5MΩ/ K cm$^{-1}$ to 1MΩ/ K cm$^{-1}$)
- Accuracy : ±1% F.S.

**Temperature** (Pt1000Ω, PB36 NTC, Ni100)
- Accuracy : ±0.3°C

**Temperature** (Pt100Ω, 8.55kΩ NTC) **mA**
- Accuracy : ±0.4°C

**Temperature compensation**
- NaCl table : ±1 %
- Matrix : ±3 %

**Note on performance specifications:**

"F.S." means maximum setting value of transmitter output. "K" means cell constant. YOKOGAWA provides conductivity sensors which cell constant are 0.1 to 10 cm$^{-1}$.
The following tolerance is added to above performance.
mA output tolerance : ± 0.02 mA of "4 - 20 mA"

**Step response:** 90 % (< 2 decades) in 7 seconds

**B. Ambient operating temperature**
: -10 to +55 °C (-10 to 130 ºF)

**C. Storage temperature**
: -30 to +70 °C (-20 to 160 ºF)

**D. Humidity**
: 10 to 90% RH non-condensing

**E. Housing**
: Cast aluminium case with chemically resistant coating, cover with flexible polycarbonate window. Case color is off-white (Equivalent to Munsell 2.5Y8.4/1.2) and cover is Deepsea Moss green (Equivalent to Munsell 0.6GY3.1/2.0). Cable entry is via two PG13.5 nylon glands. Weather resistant to IP65 and NEMA 4X standards. Pipe wall or panel mounting, using optional hardware.

**F. Data protection**
: EEPROM for configuration and logbook

**G. Automatic safeguard**
: Return to measuring mode when no key-stroke is made for 10 min.

**H. Operation protection**
: 3-digit programmable password.

**I. EMC Conformity standards** CE , N200
EN 61326-1 Class A, Table 2
(For use in industrial locations)
EN 61326-2-3
EN 61326-2-5 (Profibus communication may be influenced by strong electromagnetic field.)

### CAUTION

This instrument is a Class A product, and it is designed for use in the industrial environment. Please use this instrument in the industrial environment only.

**J. Explosionproof type**
Refer to control drawings.

| Item | Description | Code |
|---|---|---|
| Factory Mutual (FM) | **FM Intrinsically safe Approval**<br>Applicable standard: FM3600, FM3610, FM3810<br>Intrinsically Safe for Class I, Division 1, Groups ABCD<br>Class I, Zone 0, AEx ia IIC<br>Temp. Class: T4, Amb. Temp.: -10 to 55°C<br>Intrinsically Safe Apparatus Parameters<br>Vmax=31.5 V, Imax=100 mA,<br>Pmax=1.2 W, Ci=22 nF, Li=35 µH | **-A** |
| | **FM Non-incendive safe Approval**<br>Applicable standard: FM3600, FM3611, FM3810<br>Non-incendive Safe for Class I, Division 2,<br>Groups ABCD, Zone 2<br>Temp. Class: T4, Amb. Temp.: -10 to 55°C<br>Non-incendive Safe Apparatus Parameters<br>Vmax=31.5 V, Ci=22 nF, Li=35 µH | **-N** |
| CENELEC ATEX | **CENELEC ATEX (KEMA) Intrinsically safe Approval**<br>Applicable standard: EN60079-0, EN50020<br>EN60079-26<br>Certificate: KEMA 06ATEX0220 X<br>Ex ia IIC, Group: II, Category: 1G<br>Temp. Class: T4, Amb. Temp.: -10 to 55°C<br>T6, Amb. Temp.: -10 to 40°C<br>Ui=31.5 V, Ii=100 mA, Pi=1.2 W, Ci=22 nF, Li=35 µH | **-A** |
| | **CENELEC ATEX (KEMA) Type of protection "n"**<br>Applicable standard: EN60079-0:2006,<br>EN60079-15:2003<br>Certificate: KEMA 06ATEX0221<br>EEx nA [nL] IIC, Group: II, Category: 3G<br>Temp. Class: T4, Amb. Temp.: -10 to 55°C<br>T6, Amb. Temp.: -10 to 40°C<br>Ui=31.5 V, Ci=22 nF, Li=35 µH | **-N** |

2.EPS

| Item | Description | Code |
|---|---|---|
| Factory Mutual (FM) | **FM Intrinsically safe Approval**<br>Applicable standard: FM3600, FM3610, FM3810<br>Intrinsically Safe for Class I, Division 1, Groups ABCD<br>Class I, Zone 0, AEx ia IIC<br>Temp. Class: T4, Amb. Temp.: -10 to 55°C<br>Intrinsically Safe Apparatus Parameters<br>Entity { Vmax=24 V, Imax=250 mA, Pmax=1.2 W, Ci=220 pF, Li=0 µH<br>FISCO { Vmax=17.5 V, Imax=380 mA, Pmax=5.32 W, Ci=220pF, Li=0 µH | **-P**<br>**or**<br>**-F** |
| | **FM Non-incendive safe Approval**<br>Applicable standard: FM3600, FM3611, FM3810<br>Non-incendive Safe for Class I, Division 2,<br>Groups ABCD, Zone 2<br>Temp. Class: T4, Amb. Temp.: -10 to 55°C<br>Non-incendive Safe Apparatus Parameters<br>Entity { Vmax=32 V, Pmax=1.2 W, Ci=220 pF, Li=0 µH<br>FNICO { Vmax=32 V, Pmax=5.32 W, Ci=220 pF, Li=0 µH | **-B**<br>**or**<br>**-D** |

FM.EPS

# User's Manual

## Model SC202G [Style: S3], SC202S [Style: S3]
## 2-wire Conductivity or Resistivity Transmitter

**Supplement**

This is a conforming product to KC marking (Korean Certification).
Certification No.: KCC-REM-YHQ-EEN242-2

| | |
|---|---|
| EQUIPMENT NAME | : 2-Wire Transmitter for Conductivity or Resistivity<br>SC202G, SC202S |
| DATE OF MANUFACTURE | : See the nameplate of the product. |
| APPLICANT | : Yokogawa Electirc Corporation |
| MANUFACTURER | : Yokogawa Electirc Corporation |
| COUNTRY OF ORIGIN | : JAPAN |

KCC-REM-
YHQ-EEN242-2

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